FIG.1

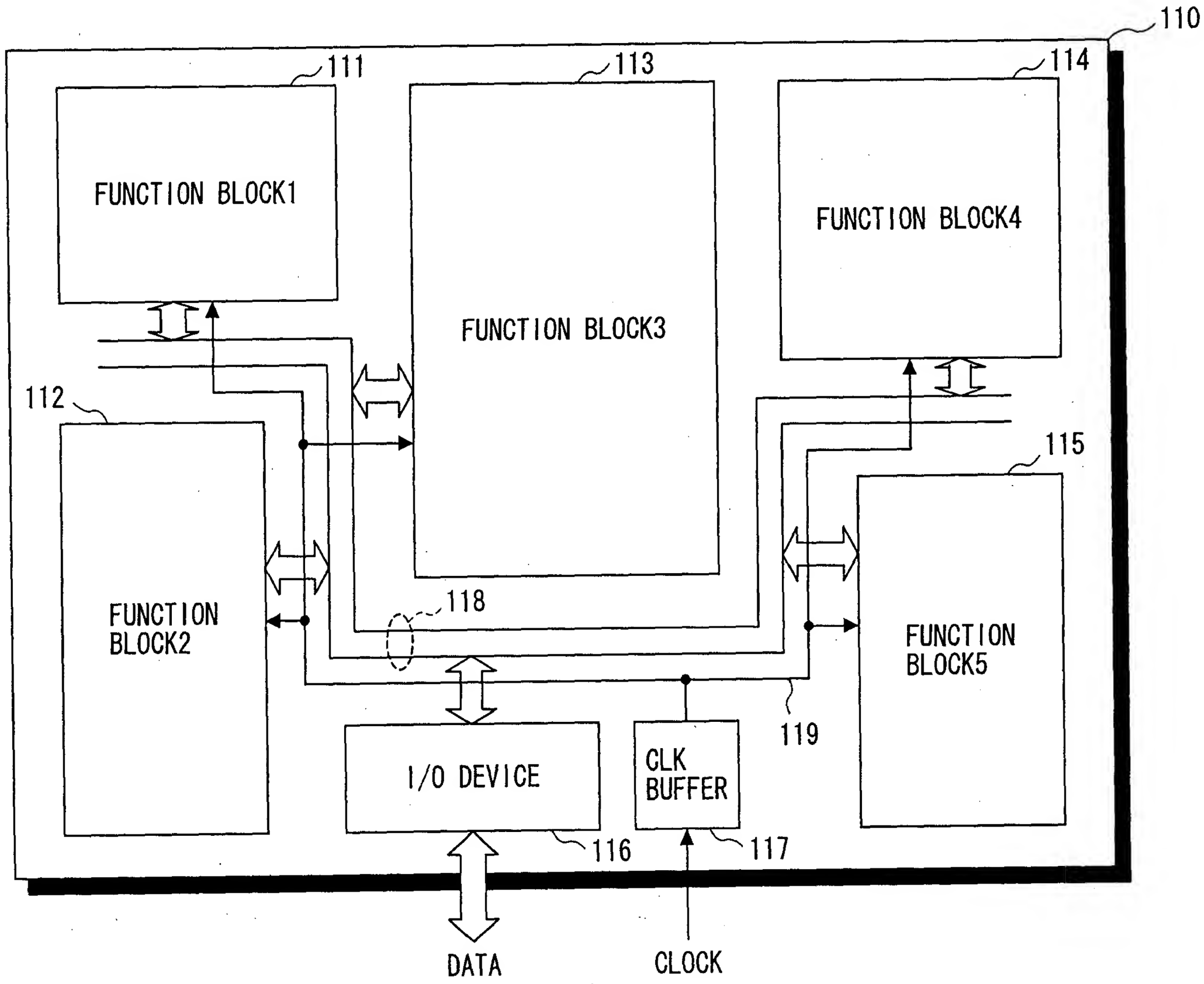

110
111
113
114
FUNCTION BLOCK1
FUNCTION BLOCK3
FUNCTION BLOCK4
112
115
FUNCTION BLOCK2
118
FUNCTION BLOCK5
119
I/O DEVICE
CLK BUFFER
116
117
DATA
CLOCK

FIG.2

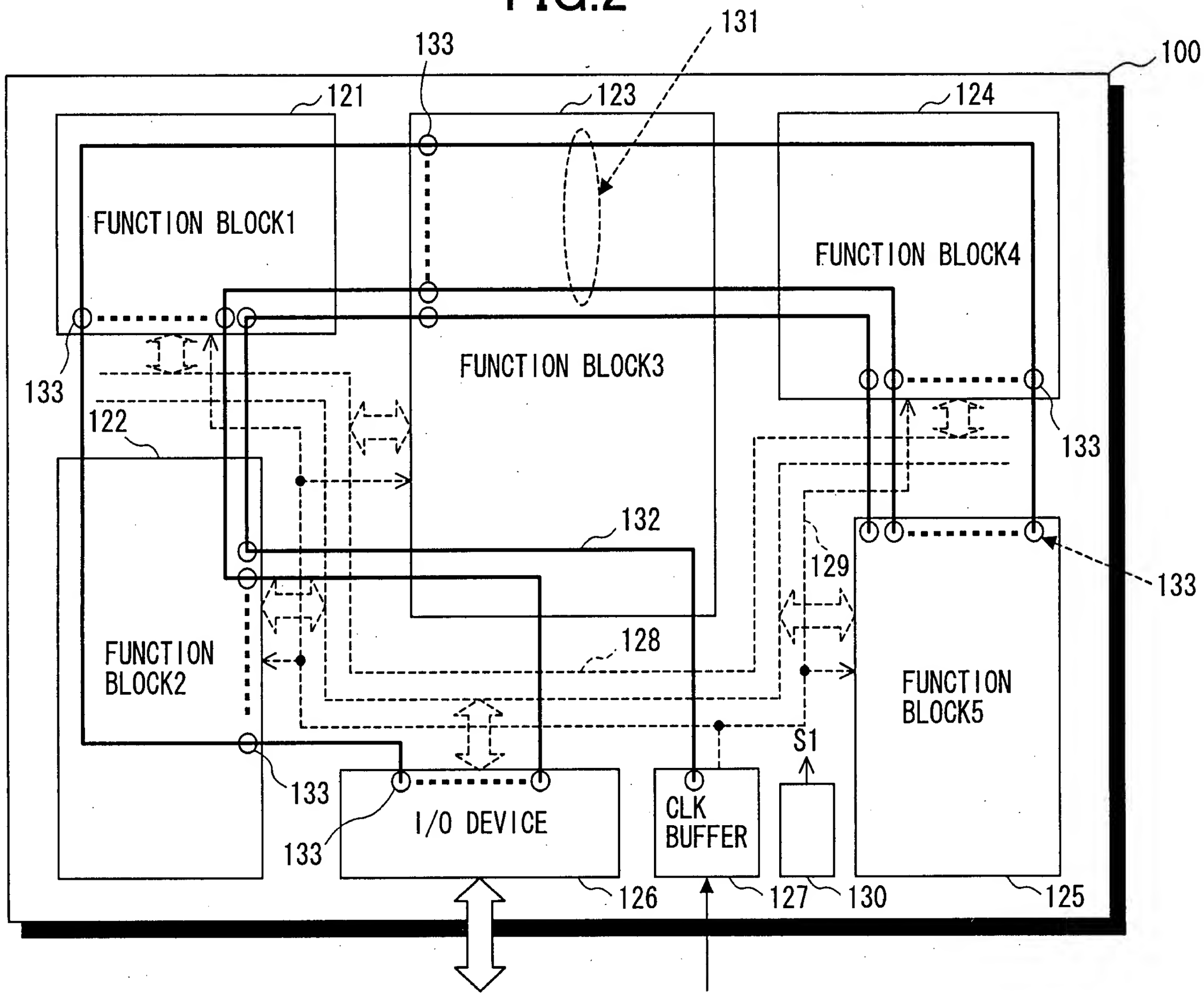

131
133
100
121
123
124
FUNCTION BLOCK1
FUNCTION BLOCK4
FUNCTION BLOCK3
133
122
133
132
129
133
128
FUNCTION
BLOCK2
FUNCTION
BLOCK5
S1
133
I/O DEVICE
CLK
BUFFER
133
126
127
130
125

FIG. 3

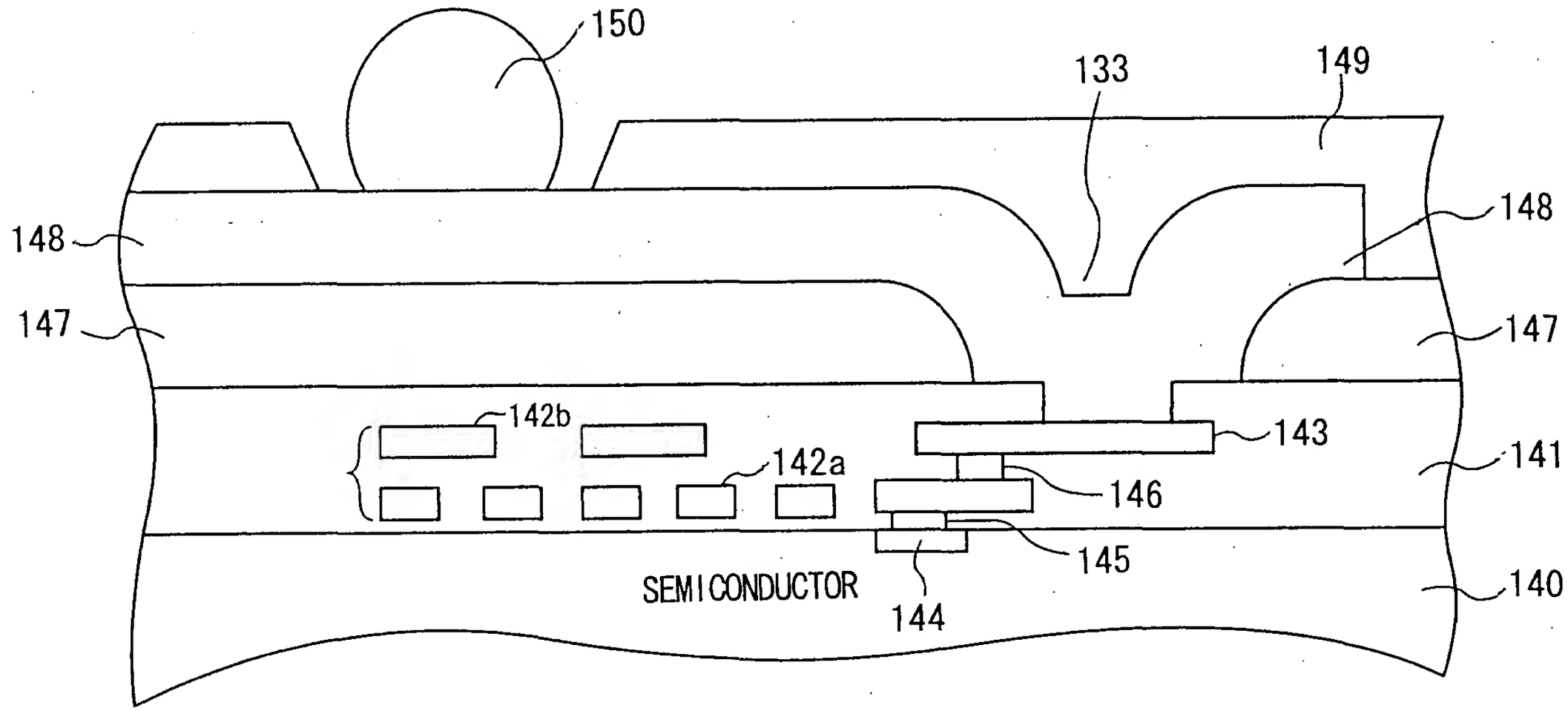

150
133
149
148
148
147
147
142b
142a
143
141
146
145
SEMICONDUCTOR
144
140

FIG.4

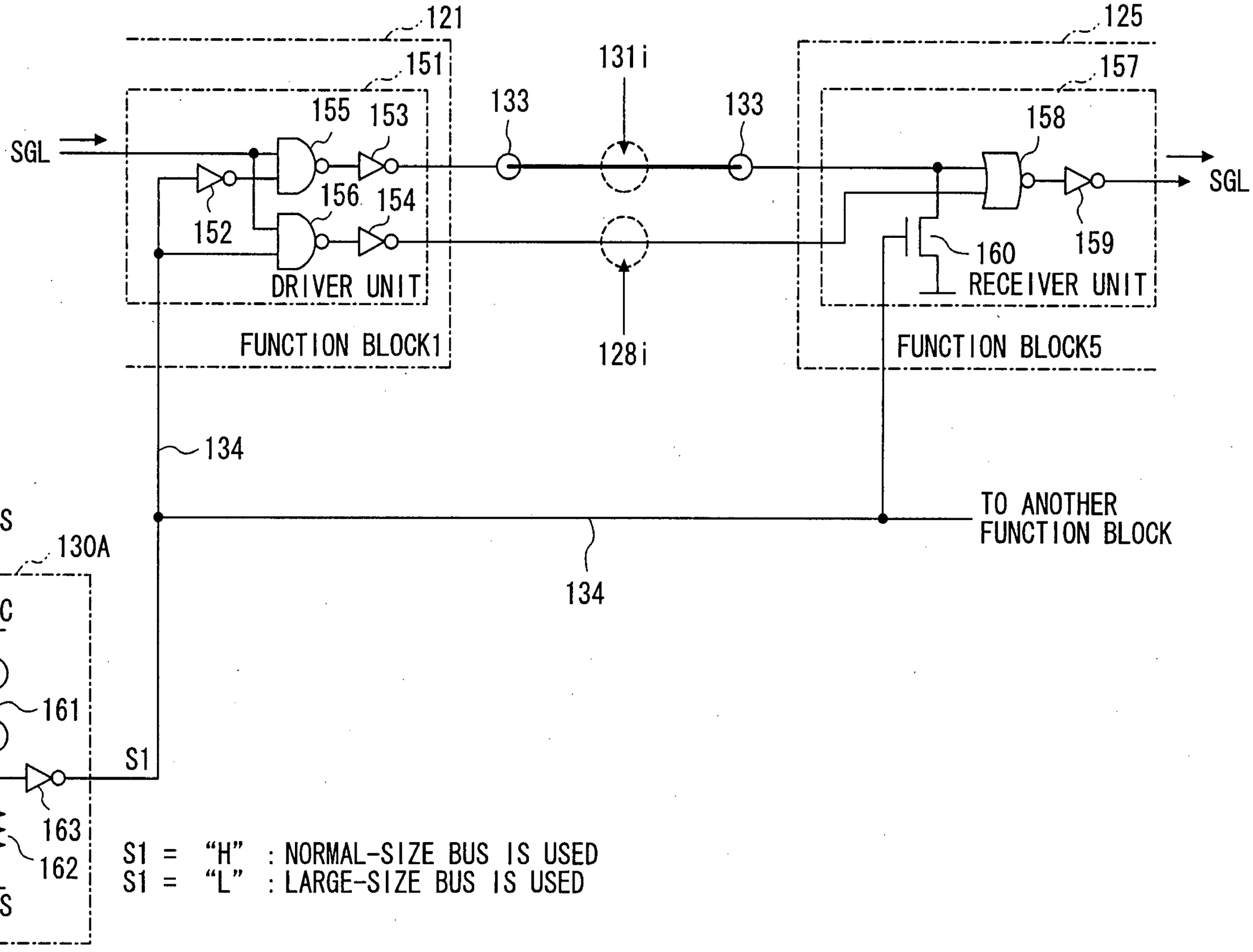

121
151
155
153
133
131i
133
125
157
158
SGL
SGL
156
154
152
160
159
DRIVER UNIT
RECEIVER UNIT
FUNCTION BLOCK1
128i
FUNCTION BLOCK5
134
TO ANOTHER
FUNCTION BLOCK
LARGE-SIZE BUS
130A
134
VCC
161
S1
163
162
VSS
S1 = "H" : NORMAL-SIZE BUS IS USED
S1 = "L" : LARGE-SIZE BUS IS USED

FIG.5

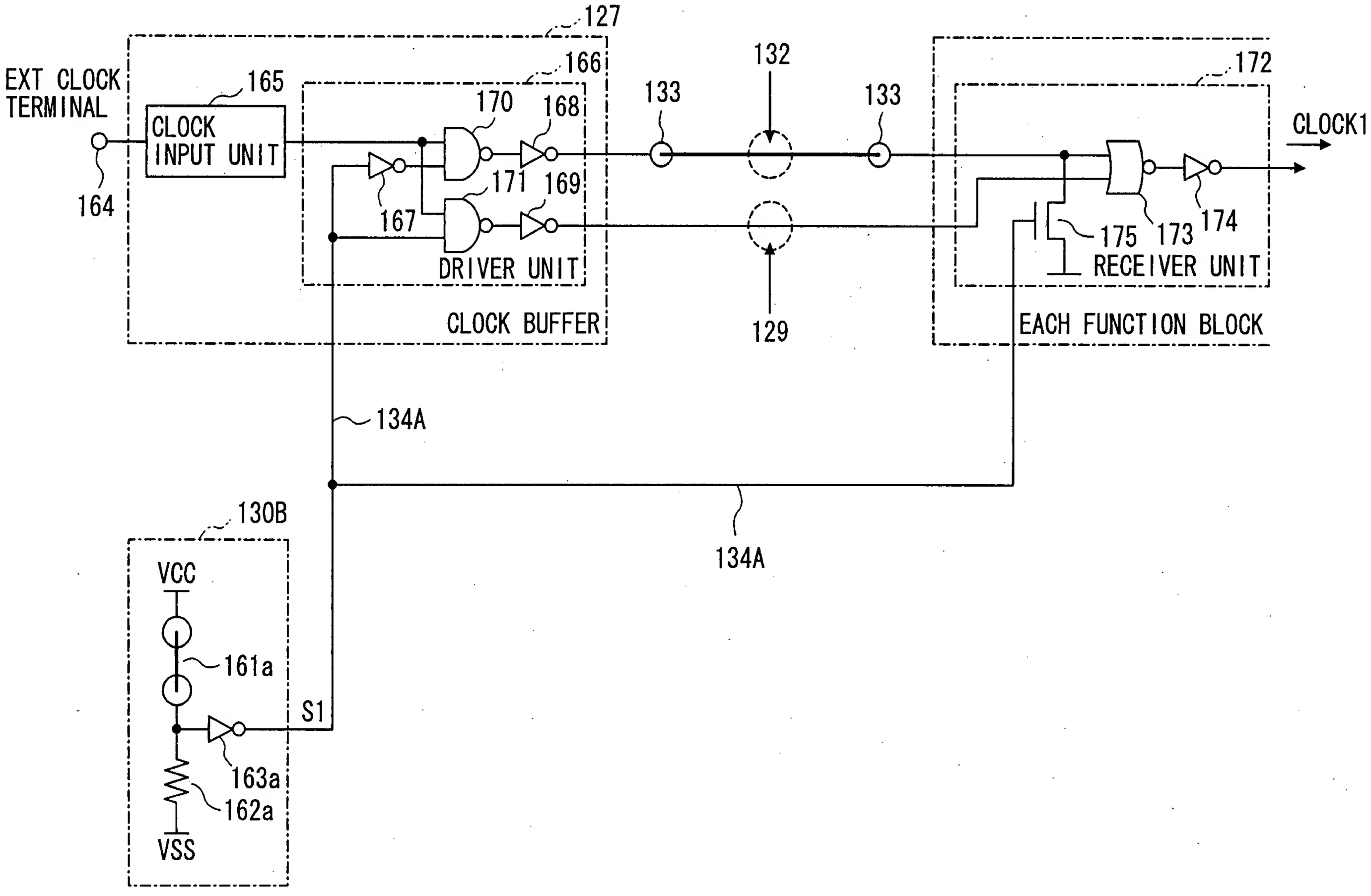

127
166
EXT CLOCK TERMINAL
165
CLOCK INPUT UNIT
164
170
168
171
169
167
DRIVER UNIT
CLOCK BUFFER
133
132
133
129
172
CLOCK1
175
173
174
RECEIVER UNIT
EACH FUNCTION BLOCK
134A
134A
130B
VCC
161a
S1
163a
162a
VSS

FIG.6

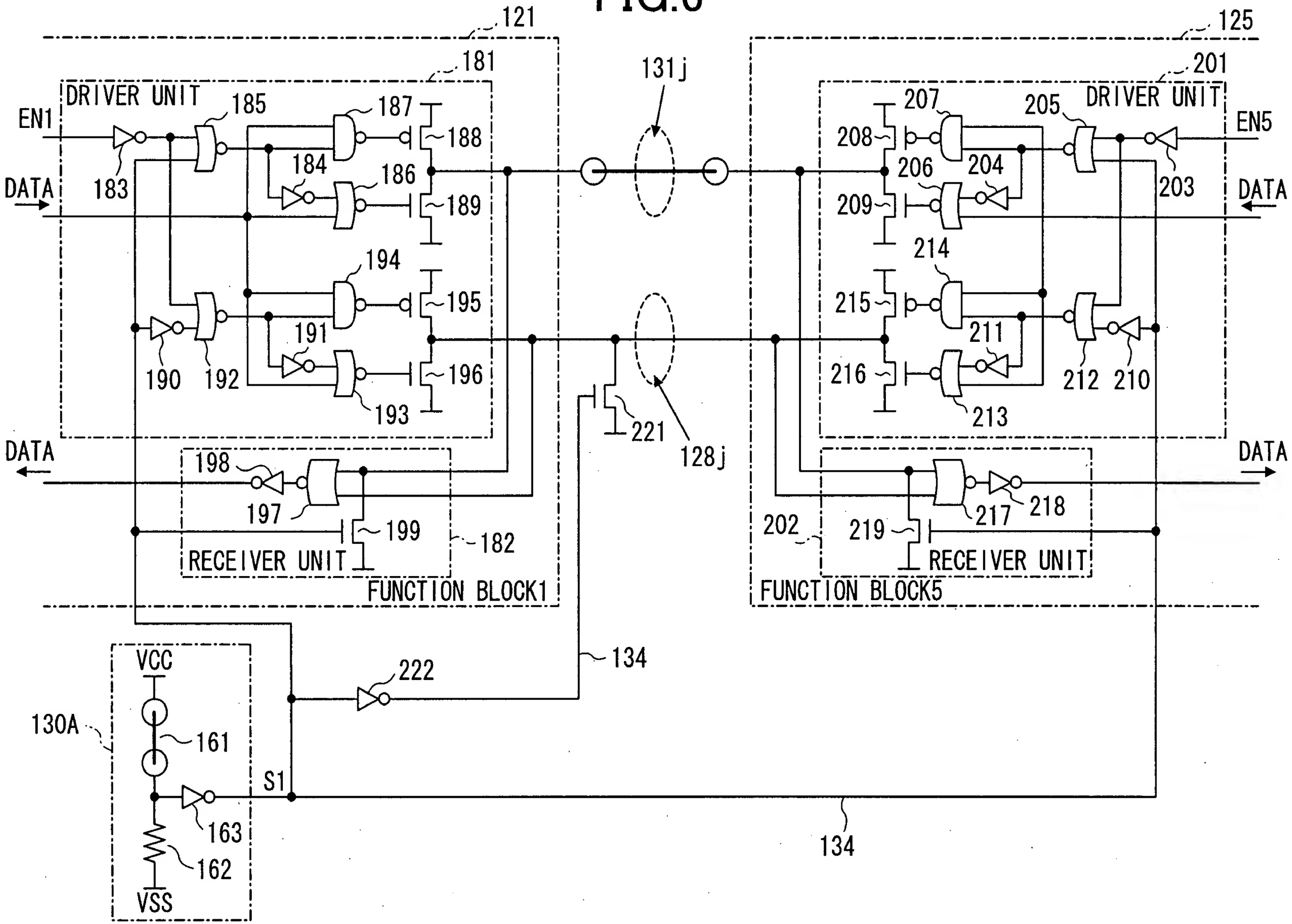

121
125
181
201
131j
DRIVER UNIT
DRIVER UNIT
EN1
EN5
DATA
DATA
183
185
187
188
184
186
189
194
195
191
196
190
192
193
207
205
208
206
204
203
209
214
215
211
216
212
210
213
221
128j
DATA
DATA
198
197
199
182
RECEIVER UNIT
FUNCTION BLOCK1
202
219
217
218
RECEIVER UNIT
FUNCTION BLOCK5
134
222
VCC
130A
161
S1
163
162
VSS
134

FIG.7A

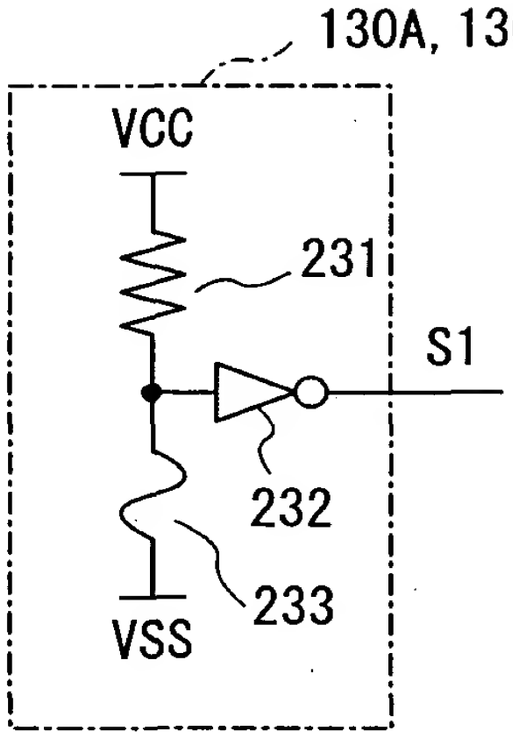


FIG.7B

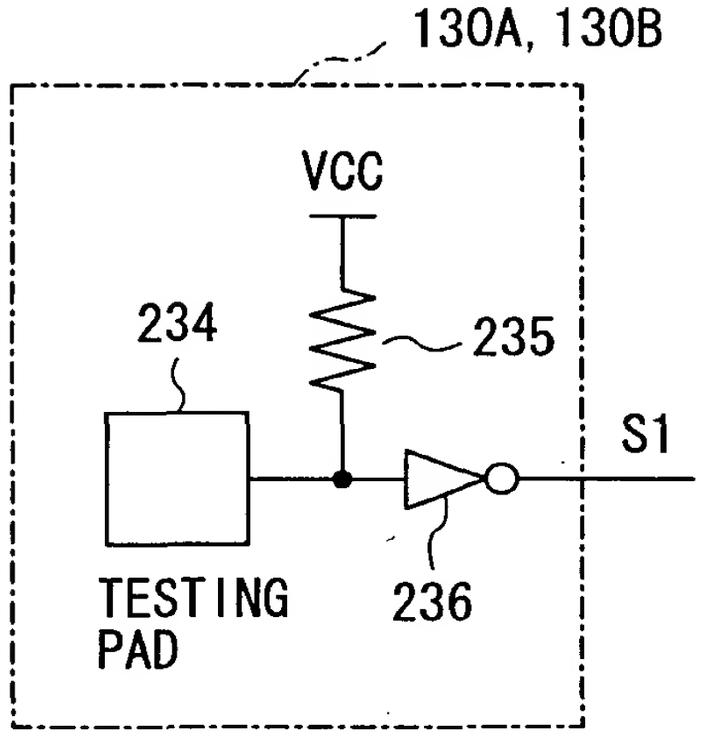


FIG.7C

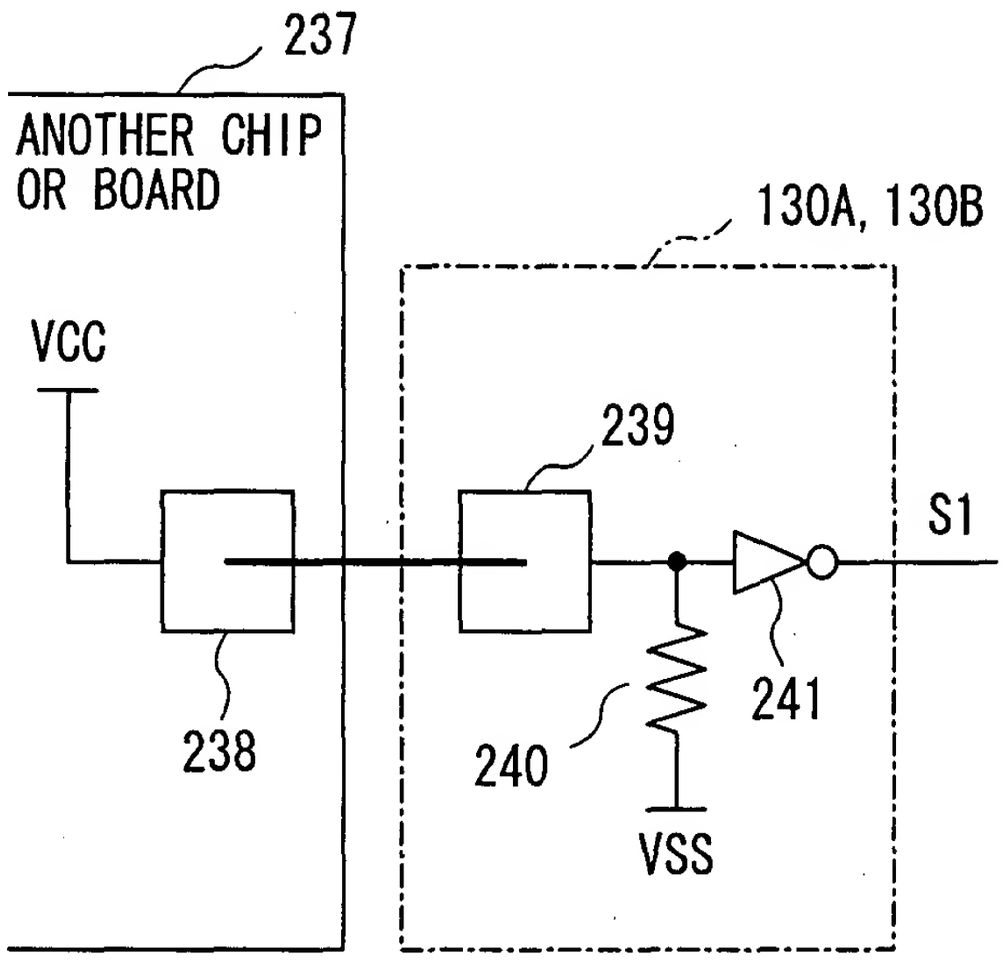

237
ANOTHER CHIP
OR BOARD
130A, 130B
VCC
239
S1
238
240
241
VSS

FIG.7D

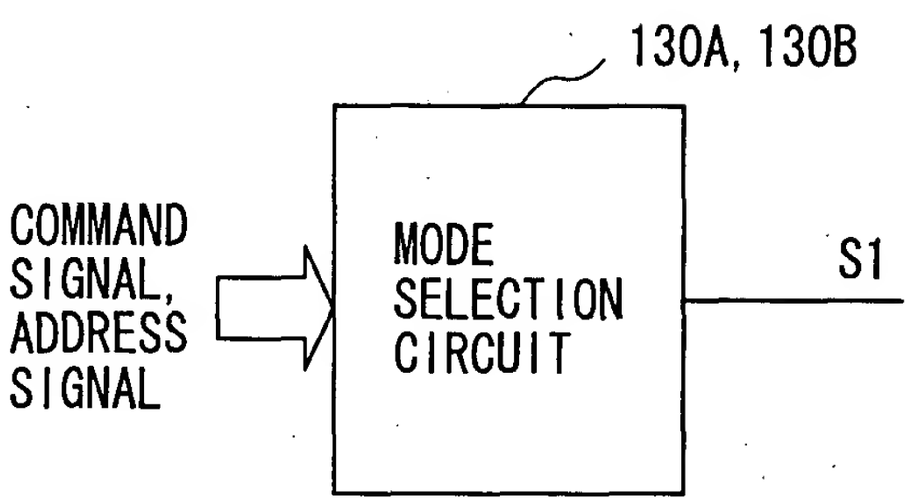

130A, 130B
COMMAND
SIGNAL,
ADDRESS
SIGNAL
MODE
SELECTION
CIRCUIT
S1

FIG.8

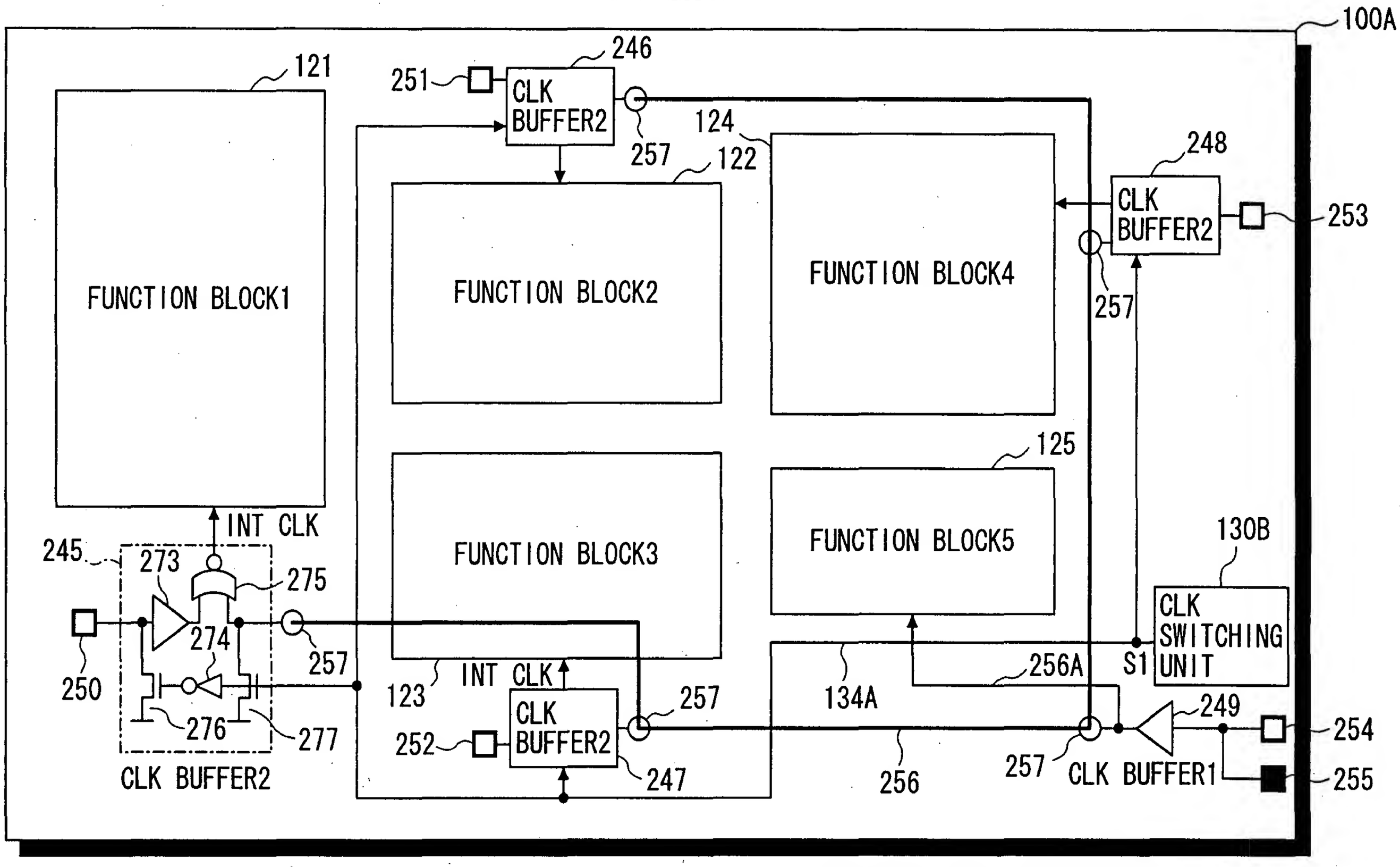
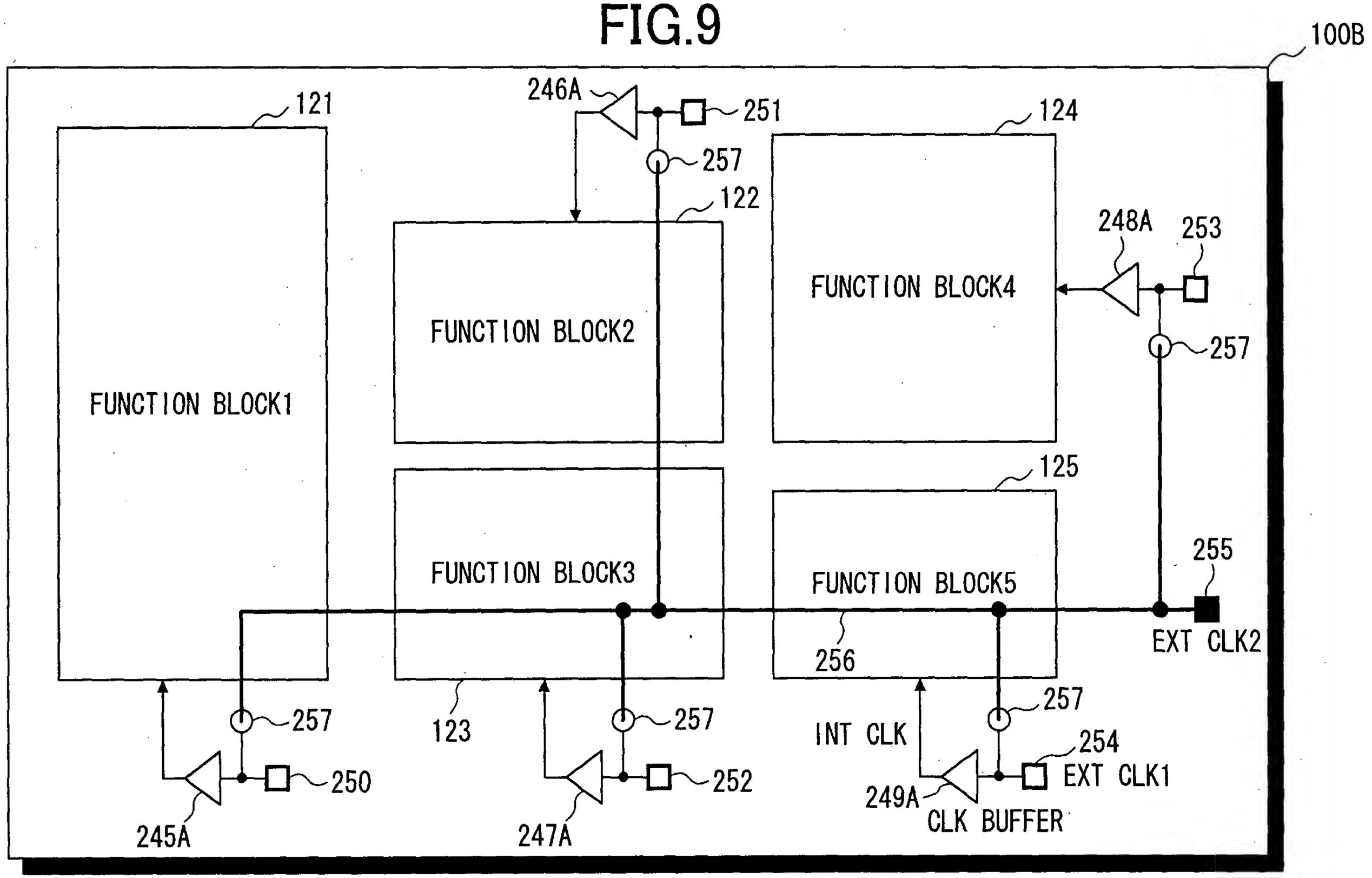

100A
121
246
251
CLK BUFFER2
257
124
122
248
CLK BUFFER2
253
FUNCTION BLOCK1
FUNCTION BLOCK2
FUNCTION BLOCK4
257
125
INT CLK
245
273
275
FUNCTION BLOCK3
FUNCTION BLOCK5
130B
CLK SWITCHING UNIT
274
257
256A
S1
250
123
INT CLK
134A
CLK BUFFER2
257
249
254
276
277
252
247
257
CLK BUFFER1
255
256
CLK BUFFER2
LARGE-SIZE BUS CONNECTION
EXT PAD1:FORMED IN LAYER ON NORMAL BUS
EXT PAD2:FORMED IN LAYER OF LARGE-SIZE BUS
CONTACT OF LARGE-SIZE BUS AND CIRCUIT

FIG.9



LARGE-SIZE BUS CONNECTION

EXT PAD1:FORMED IN LAYER ON NORMAL BUS

EXT PAD2:FORMED IN LAYER OF LARGE-SIZE BUS

CONTACT OF LARGE-SIZE BUS AND CIRCUIT

FIG.10

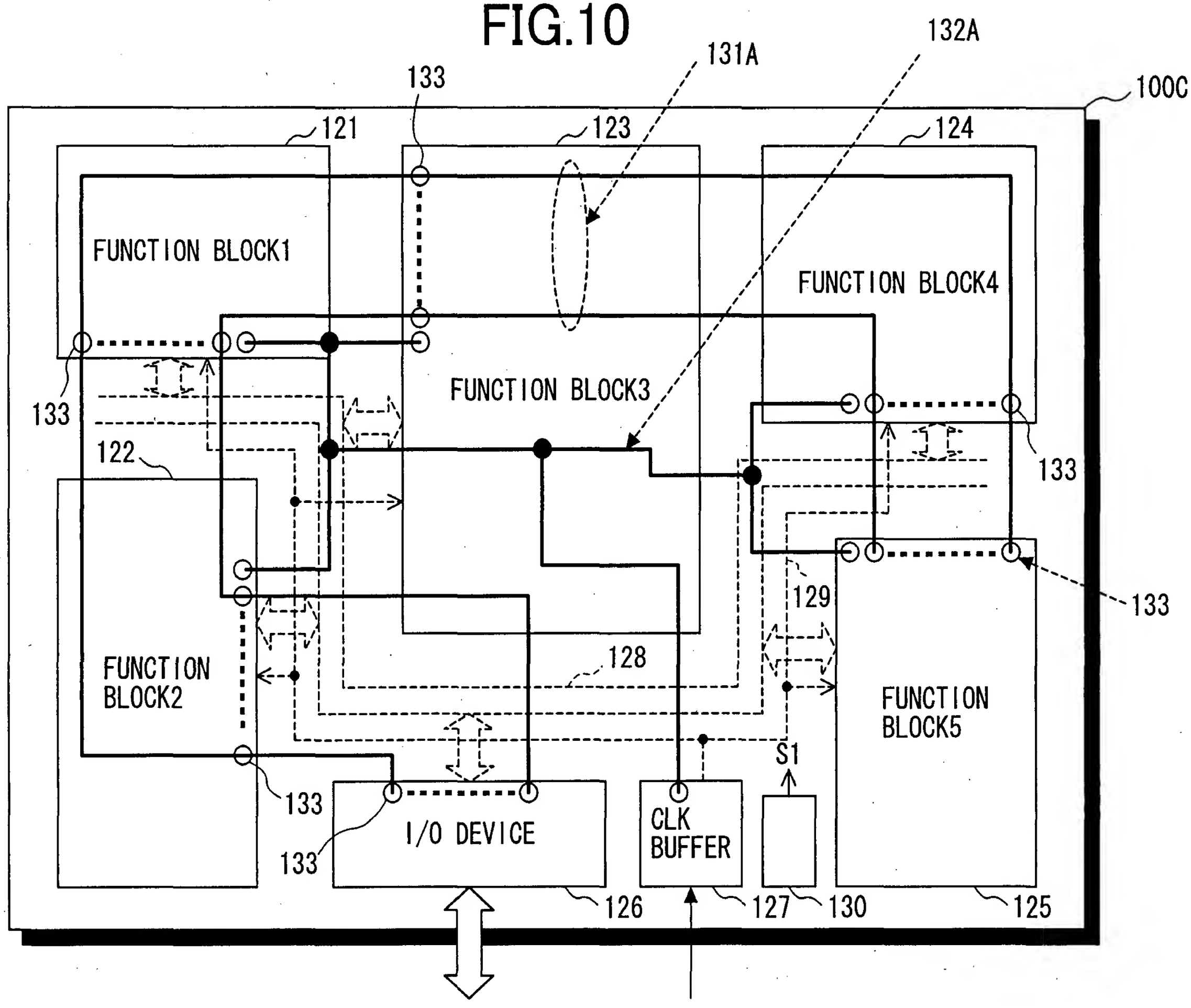
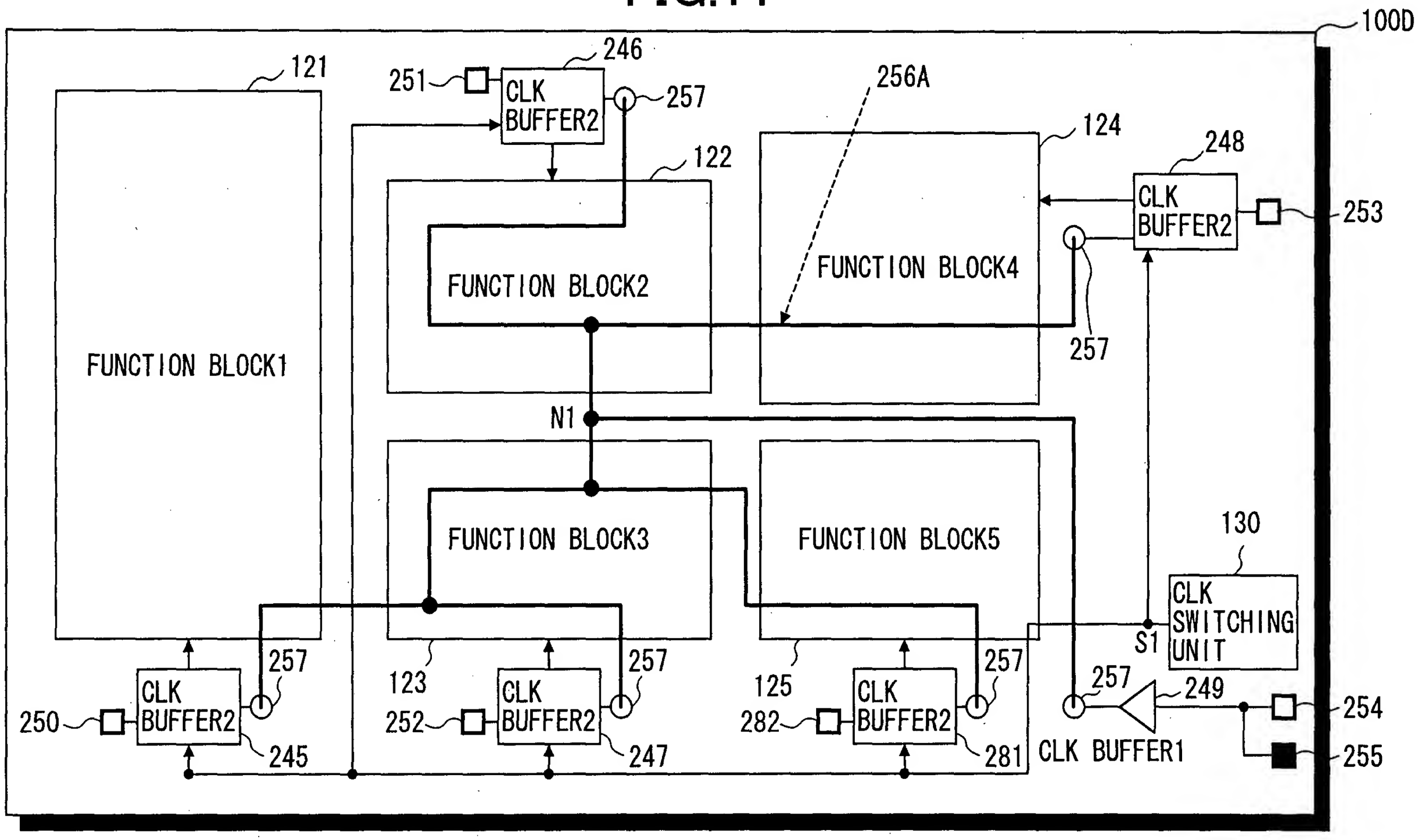

132A
131A
133
100C
121
123
124
FUNCTION BLOCK1
FUNCTION BLOCK4
FUNCTION BLOCK3
133
122
133
129
133
128
FUNCTION
BLOCK2
FUNCTION
BLOCK5
S1
133
I/O DEVICE
CLK
BUFFER
133
126
127
130
125

FIG.11



LARGE-SIZE BUS CONNECTION

EXT PAD1:FORMED IN LAYER ON NORMAL BUS

EXT PAD2:FORMED IN LAYER OF LARGE-SIZE BUS

CONTACT OF LARGE-SIZE BUS AND CIRCUIT

FIG.12

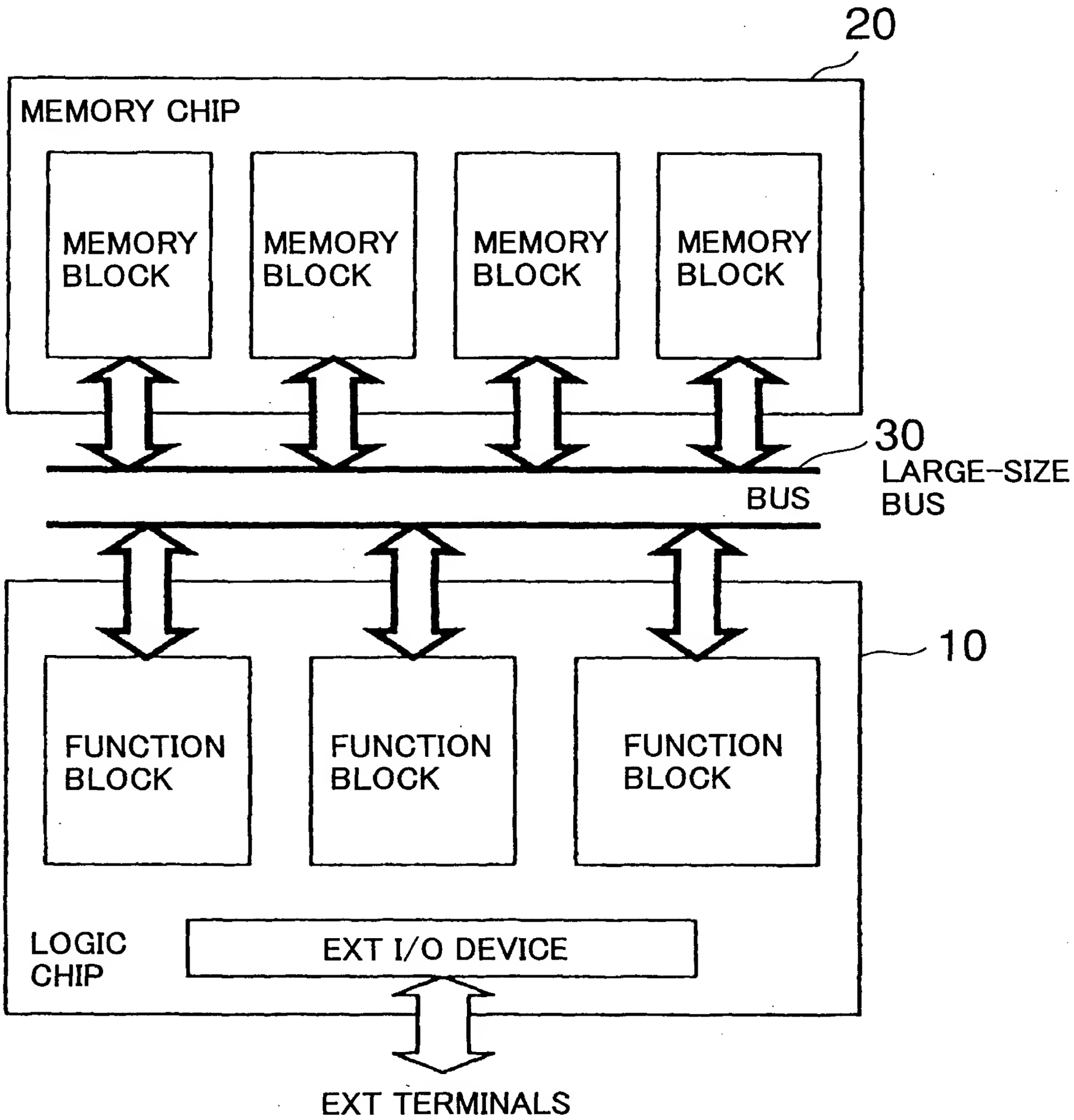

20
MEMORY CHIP
MEMORY BLOCK
MEMORY BLOCK
MEMORY BLOCK
MEMORY BLOCK
30
LARGE-SIZE BUS
BUS
10
FUNCTION BLOCK
FUNCTION BLOCK
FUNCTION BLOCK
LOGIC CHIP
EXT I/O DEVICE
EXT TERMINALS

FIG.13

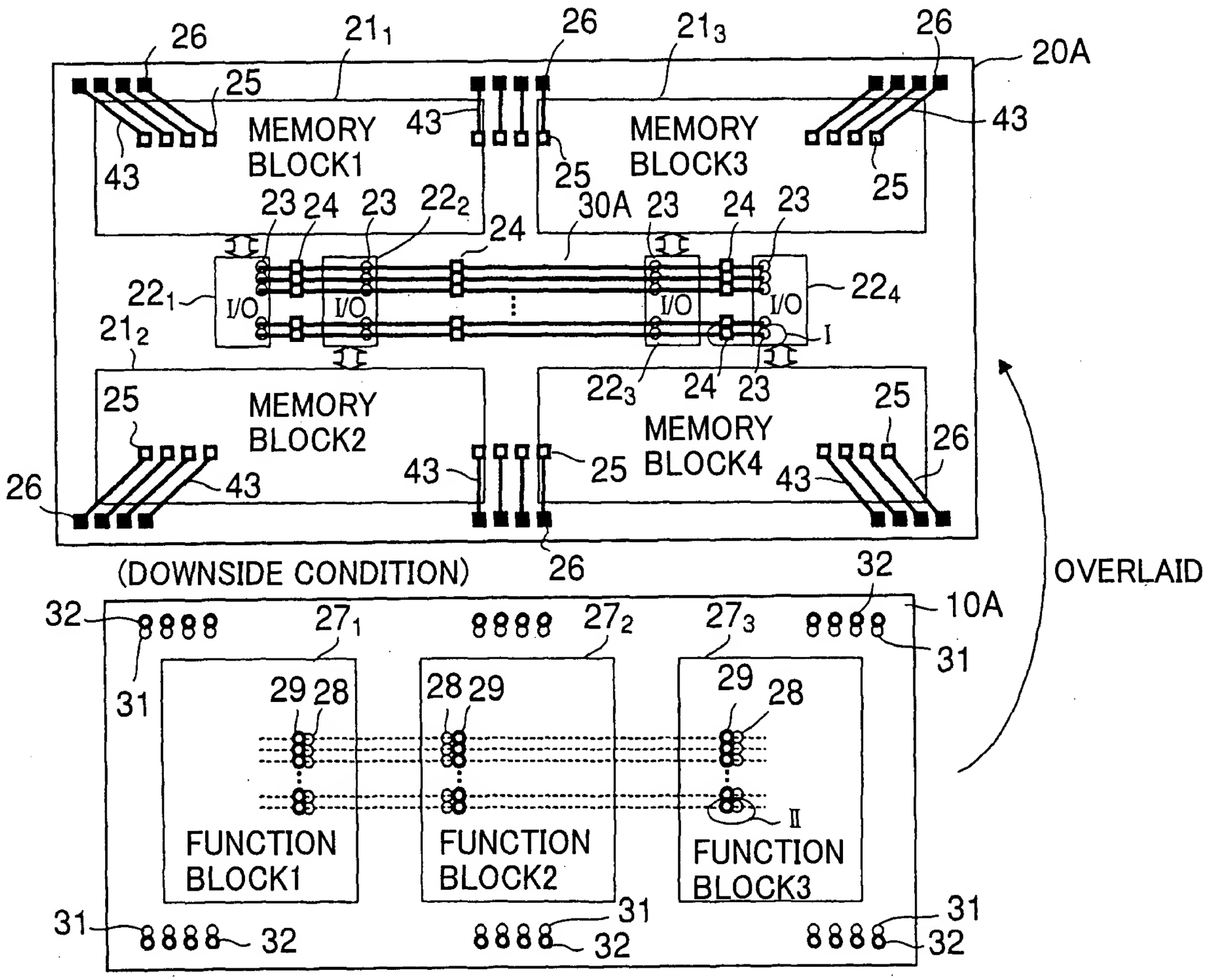

MEMORY BLOCK1
MEMORY BLOCK2
MEMORY BLOCK3
MEMORY BLOCK4
I/O
20A
10A
30A
(DOWNSIDE CONDITION)
OVERLAID
FUNCTION BLOCK1
FUNCTION BLOCK2
FUNCTION BLOCK3

FIG. 14

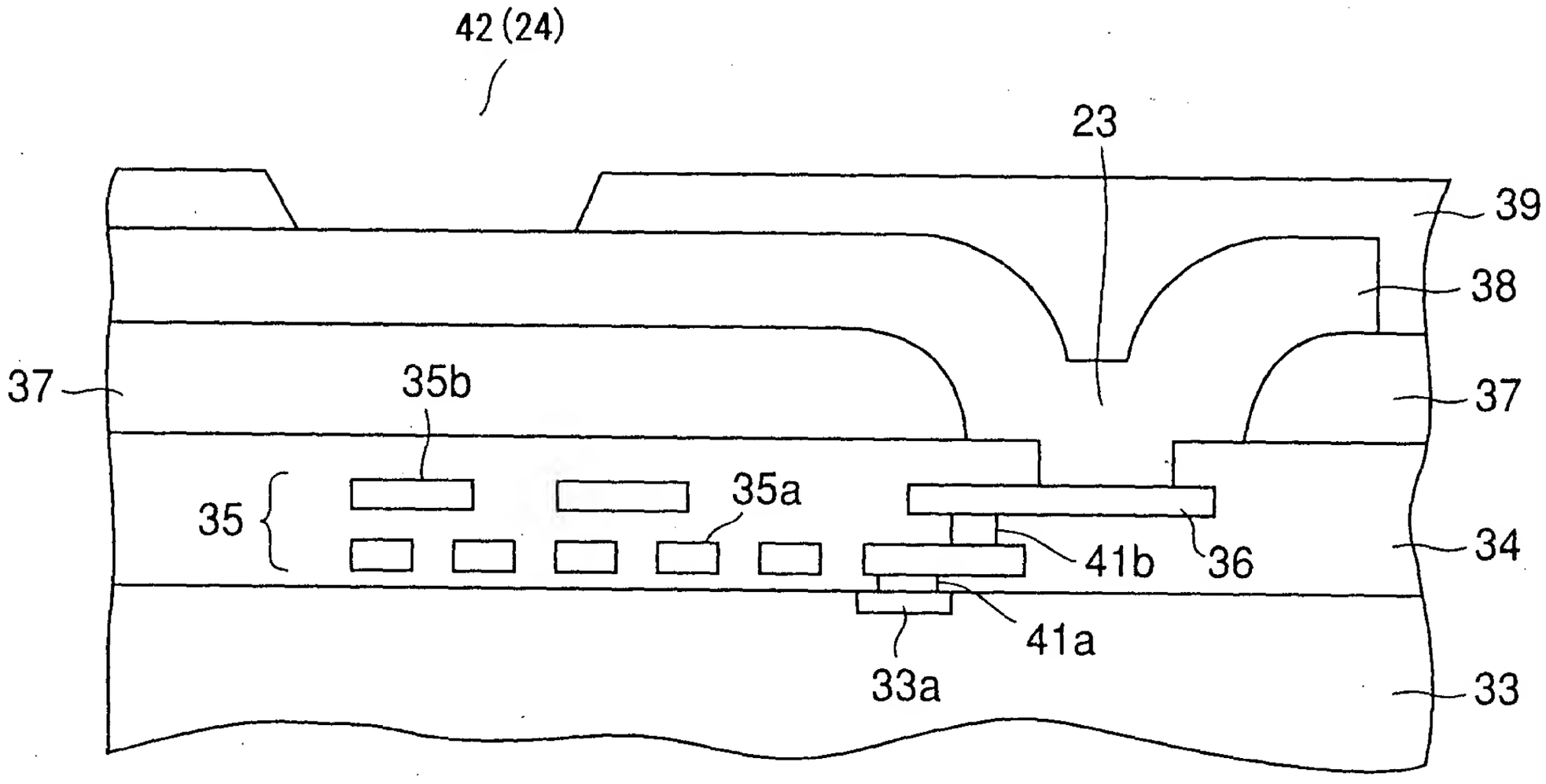


FIG. 15

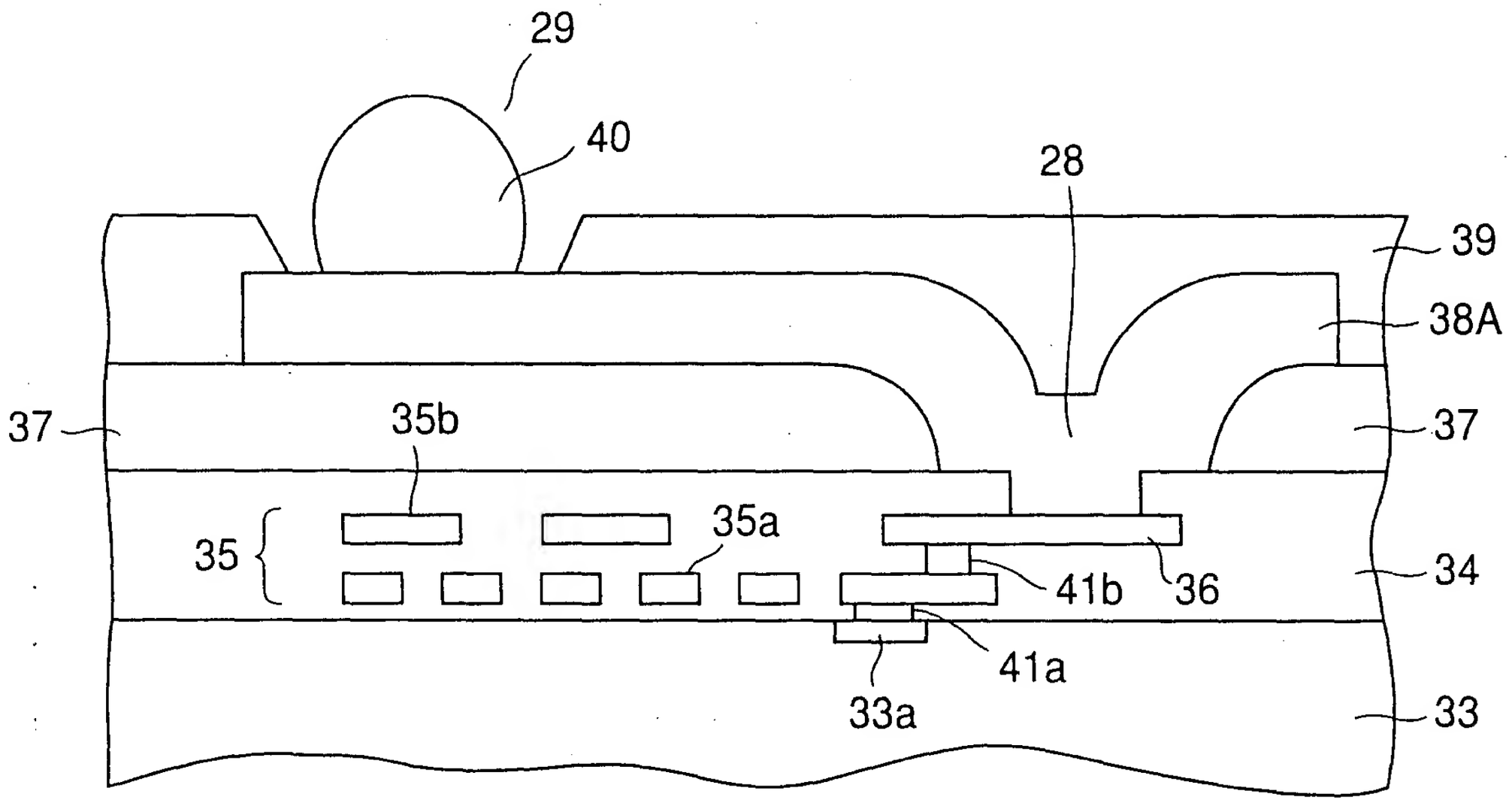


FIG.16

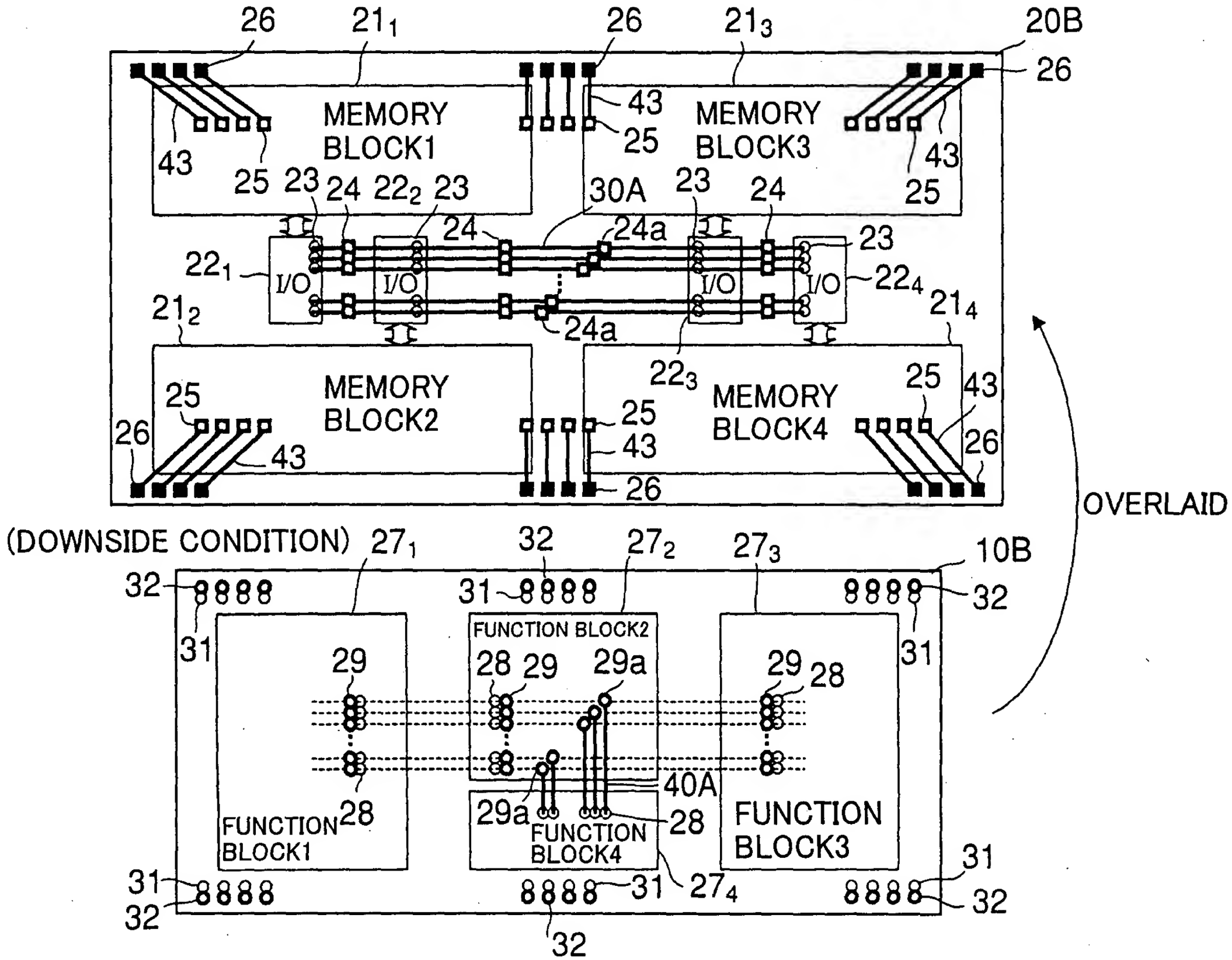

26
21_1
26
21_3
20B
26
MEMORY BLOCK1
43
25
43
25
MEMORY BLOCK3
43
25
25 23 24 22_2 23
30A
23 24
24
24a
23
22_1
I/O
I/O
I/O
I/O
22_4
21_2
24a
21_4
22_3
25
MEMORY BLOCK2
25
43
26
25
43
26
43
MEMORY BLOCK4
26
26
OVERLAID
(DOWNSIDE CONDITION)
27_1
32
27_2
27_3
10B
32
31
8888
8888
8888
32
31
FUNCTION BLOCK2
29
28 29
29a
29 28
31
40A
28
29a
FUNCTION BLOCK4
28
FUNCTION BLOCK1
FUNCTION BLOCK3
31
8888
8888
31
27_4
8888
31
32
32
32

FIG.17

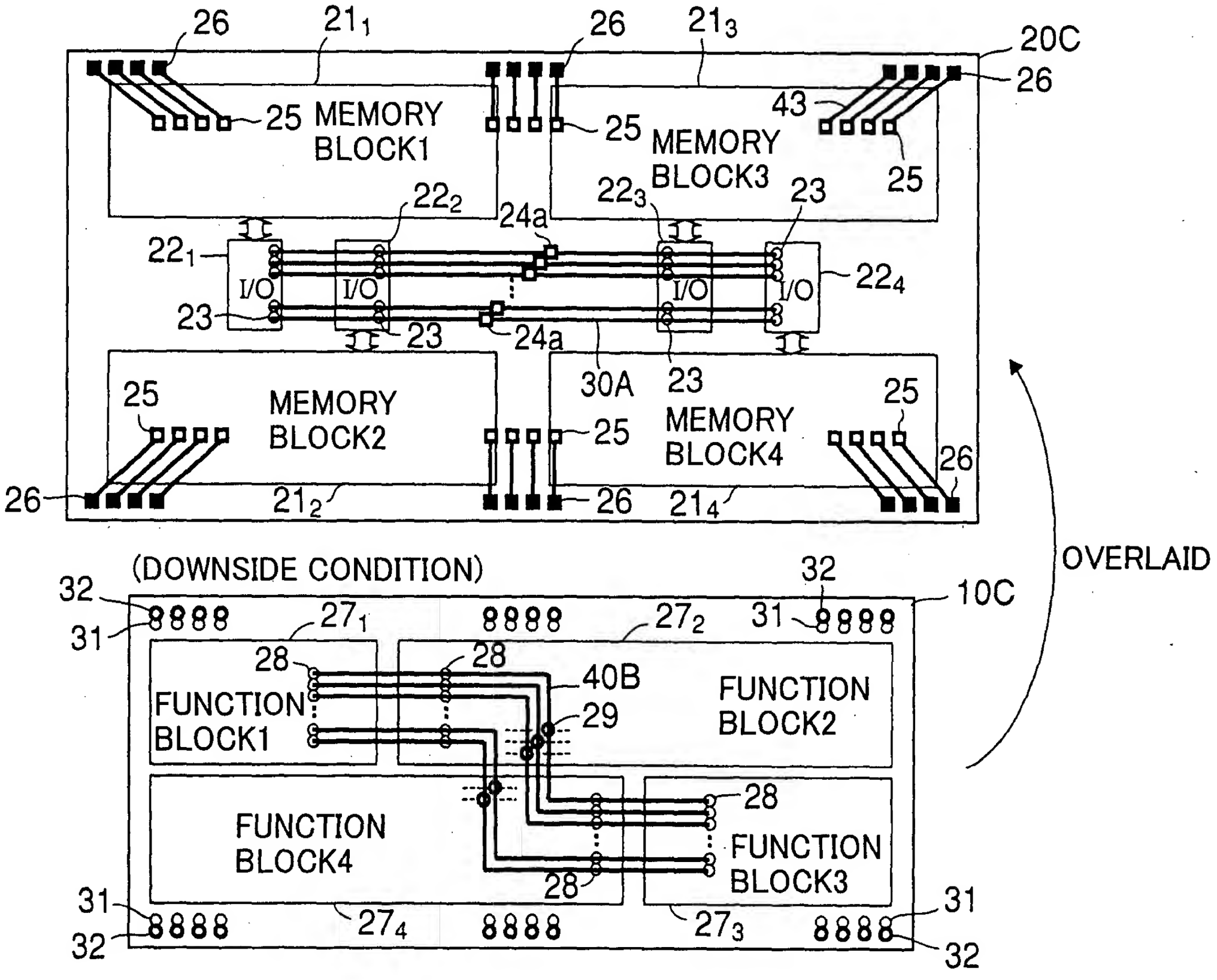

26
21_1
26
21_3
20C
26
25 MEMORY BLOCK1
25
MEMORY BLOCK3
43
25
22_2
24a
22_3
23
22_1
I/O
I/O
I/O
I/O
22_4
23
23
24a
25
MEMORY BLOCK2
30A
23
MEMORY BLOCK4
25
25
26
26
21_2
26
21_4
OVERLAID
(DOWNSIDE CONDITION)
32
32
10C
31
8888
27_1
8888
27_2
31
8888
28
28
40B
FUNCTION BLOCK1
29
FUNCTION BLOCK2
28
FUNCTION BLOCK4
FUNCTION BLOCK3
28
31
31
8888
27_4
8888
27_3
8888
32
32

FIG.18

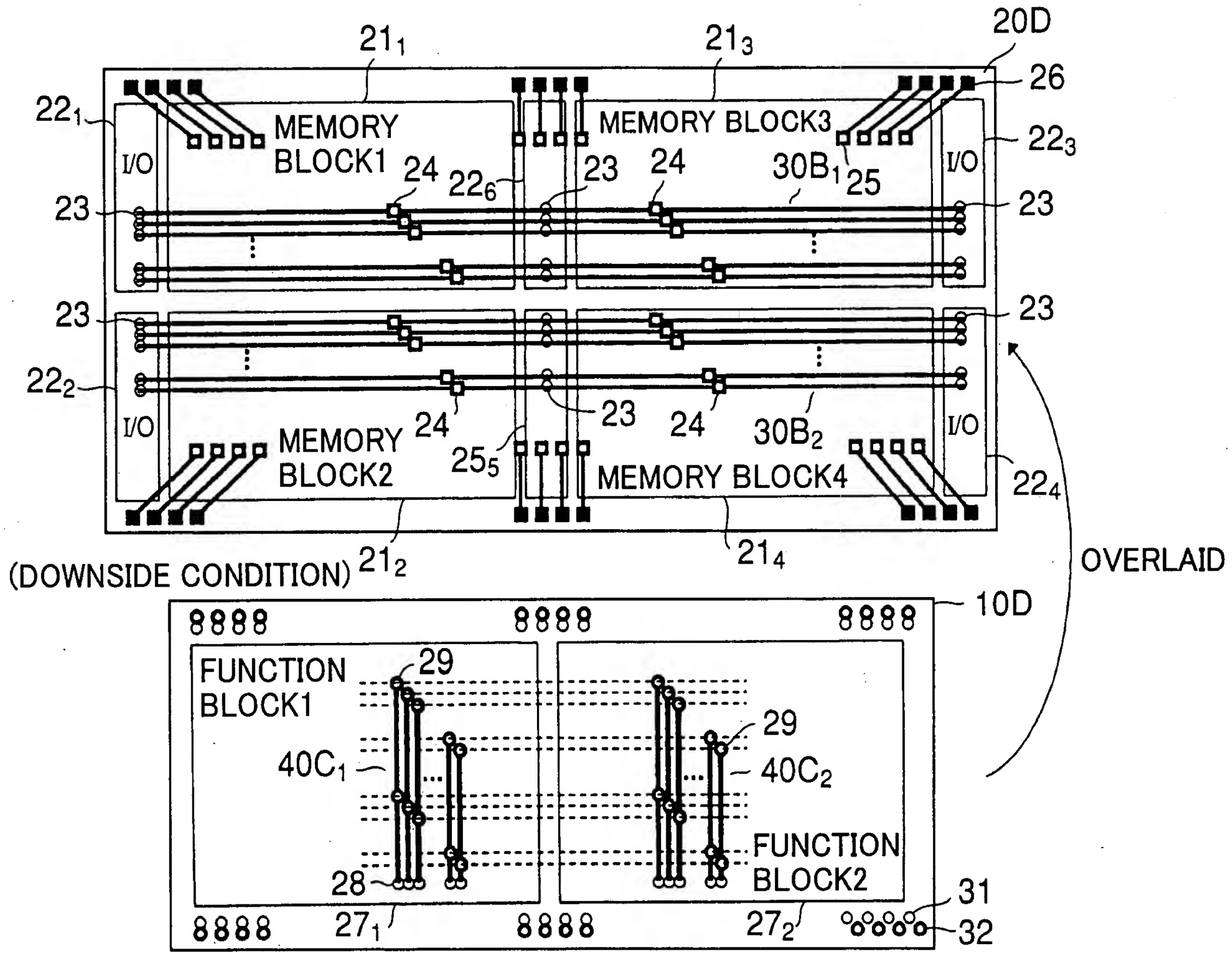

21_1
21_3
20D
26
22_1
MEMORY BLOCK1
MEMORY BLOCK3
I/O
24
22_6
23
24
$30B_1$
25
I/O
22_3
23
23
23
22_2
I/O
24
23
24
$30B_2$
I/O
MEMORY BLOCK2
25_5
MEMORY BLOCK4
22_4
(DOWNSIDE CONDITION)
21_2
21_4
OVERLAID
10D
8888
8888
8888
FUNCTION BLOCK1
29
$40C_1$
28
29
$40C_2$
FUNCTION BLOCK2
31
32
8888
27_1
8888
27_2

FIG.19

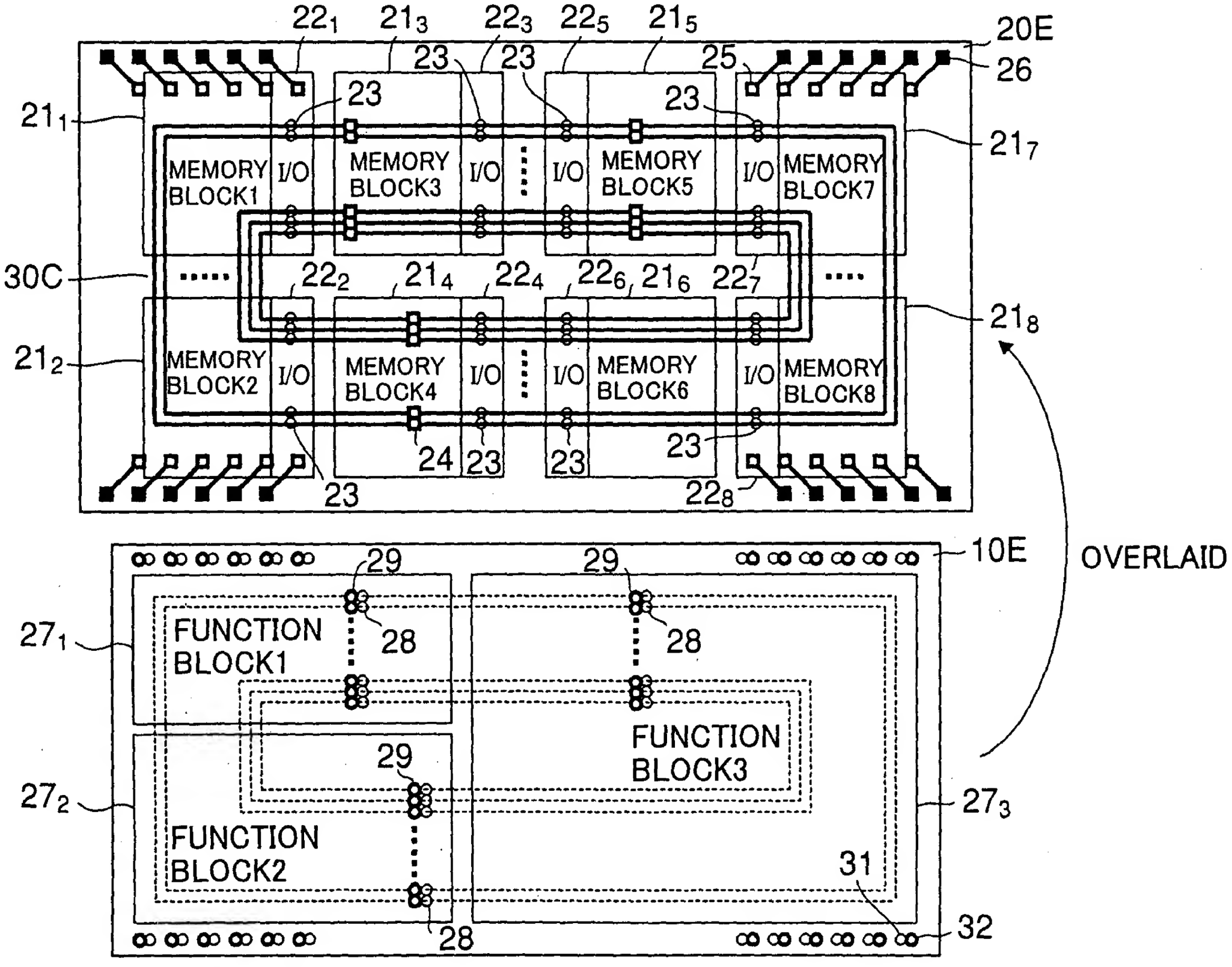

22_1
21_3
22_3
22_5
21_5
20E
23
25
26
21_1
21_7
MEMORY BLOCK1
I/O
MEMORY BLOCK3
MEMORY BLOCK5
MEMORY BLOCK7
30C
22_2
21_4
22_4
22_6
21_6
22_7
21_8
21_2
MEMORY BLOCK2
MEMORY BLOCK4
MEMORY BLOCK6
MEMORY BLOCK8
24
22_8
10E
OVERLAID
29
28
27_1
FUNCTION BLOCK1
FUNCTION BLOCK3
27_2
FUNCTION BLOCK2
27_3
31
32

FIG.20

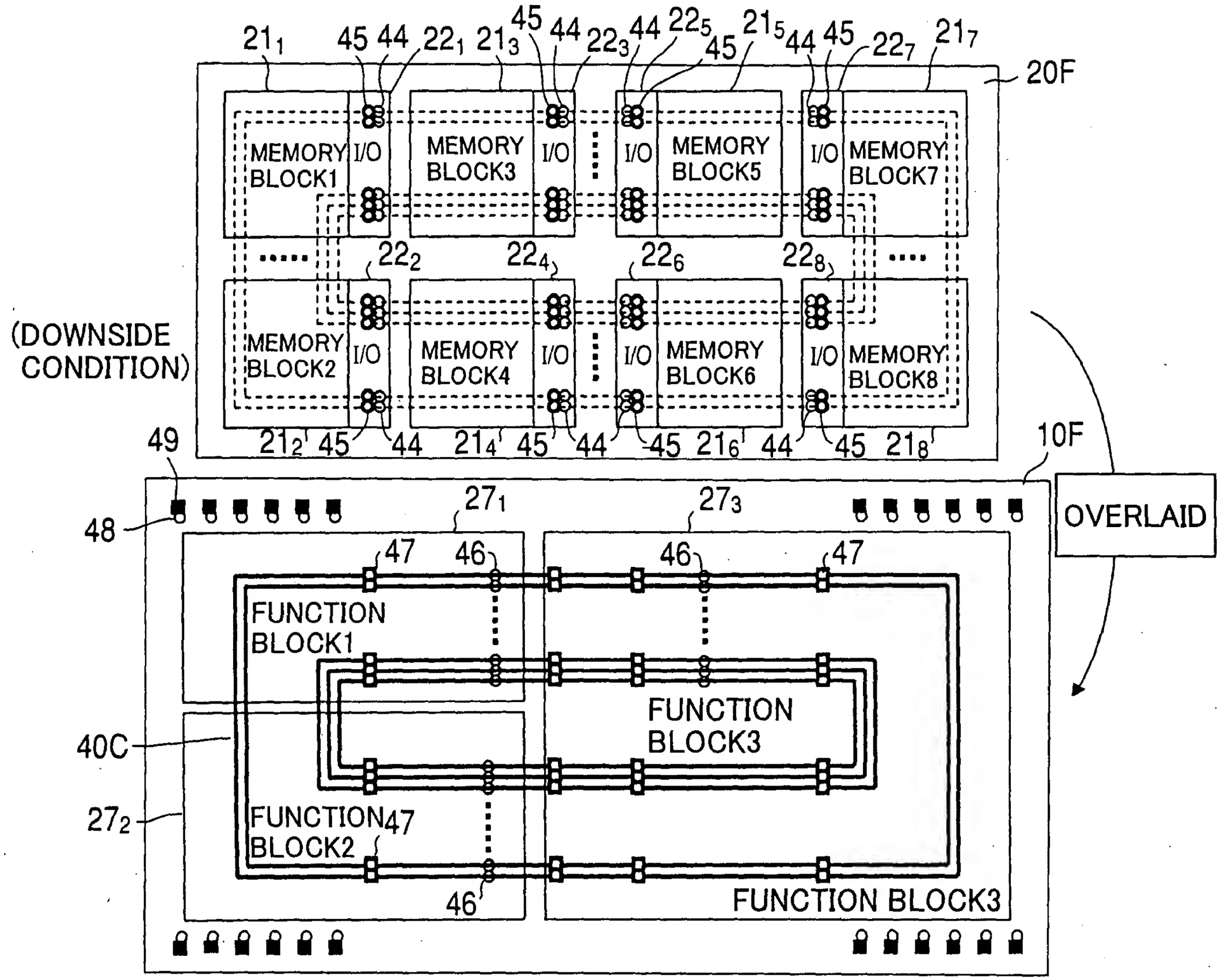

21_1
45
44
22_1
21_3
45
44
22_3
44
22_5
45
21_5
44
45
22_7
21_7
20F
MEMORY BLOCK1
I/O
MEMORY BLOCK3
I/O
I/O
MEMORY BLOCK5
I/O
MEMORY BLOCK7
22_2
22_4
22_6
22_8
(DOWNSIDE CONDITION)
MEMORY BLOCK2
I/O
MEMORY BLOCK4
I/O
I/O
MEMORY BLOCK6
I/O
MEMORY BLOCK8
49
21_2 45
44
21_4 45
44
45 21_6 44
45 21_8
10F
OVERLAID
48
27_1
27_3
47
46
46
47
FUNCTION BLOCK1
FUNCTION BLOCK3
40C
27_2
FUNCTION BLOCK2
47
46
FUNCTION BLOCK3

FIG.21

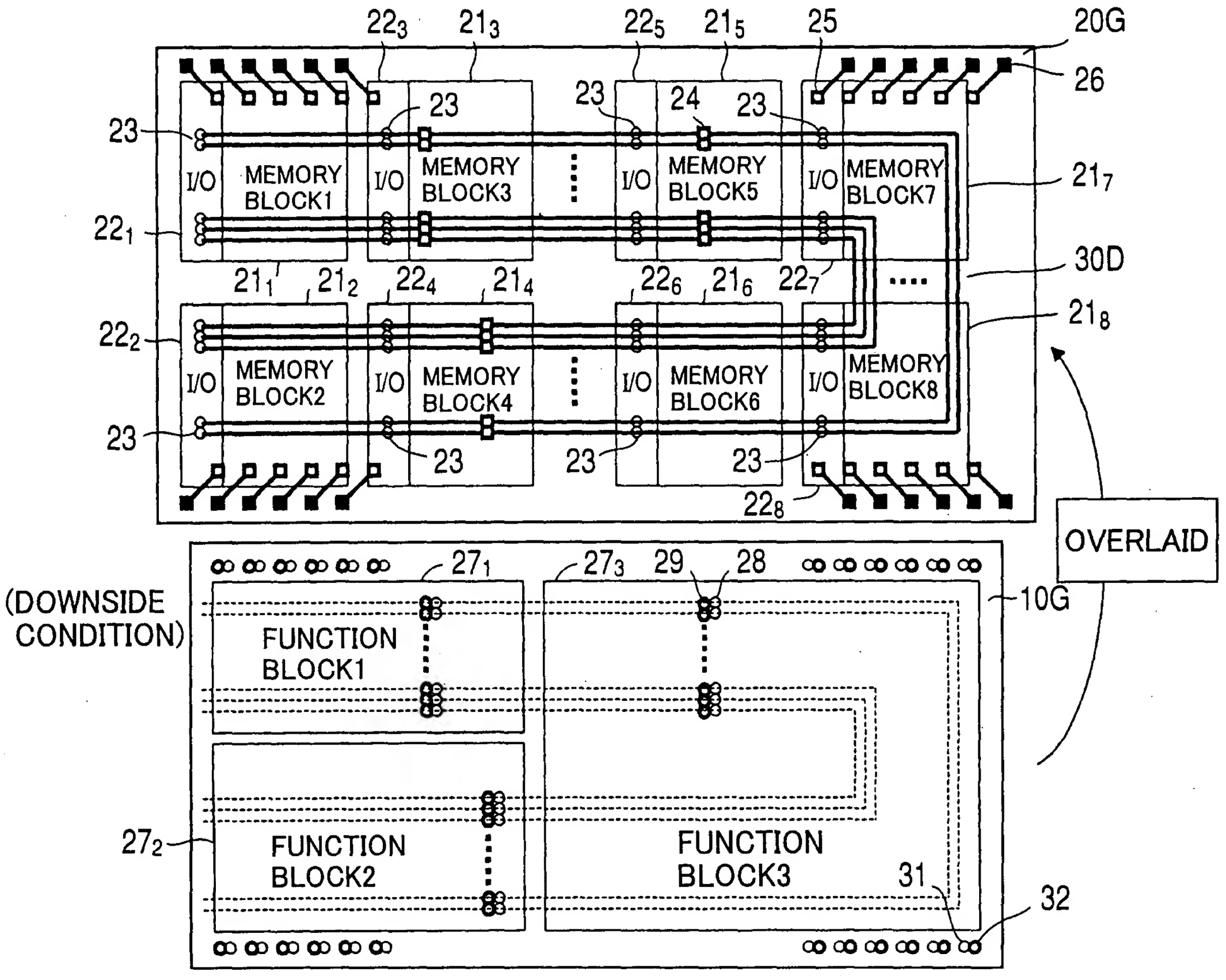

22_3
21_3
22_5
21_5
25
20G
26
23
24
21_7
22_1
21_1
21_2
22_4
21_4
22_6
21_6
22_7
30D
21_8
22_2
MEMORY BLOCK1
MEMORY BLOCK3
MEMORY BLOCK5
MEMORY BLOCK7
MEMORY BLOCK2
MEMORY BLOCK4
MEMORY BLOCK6
MEMORY BLOCK8
I/O
22_8
OVERLAID
(DOWNSIDE CONDITION)
27_1
27_3
29
28
10G
FUNCTION BLOCK1
FUNCTION BLOCK2
FUNCTION BLOCK3
27_2
31
32

FIG.22

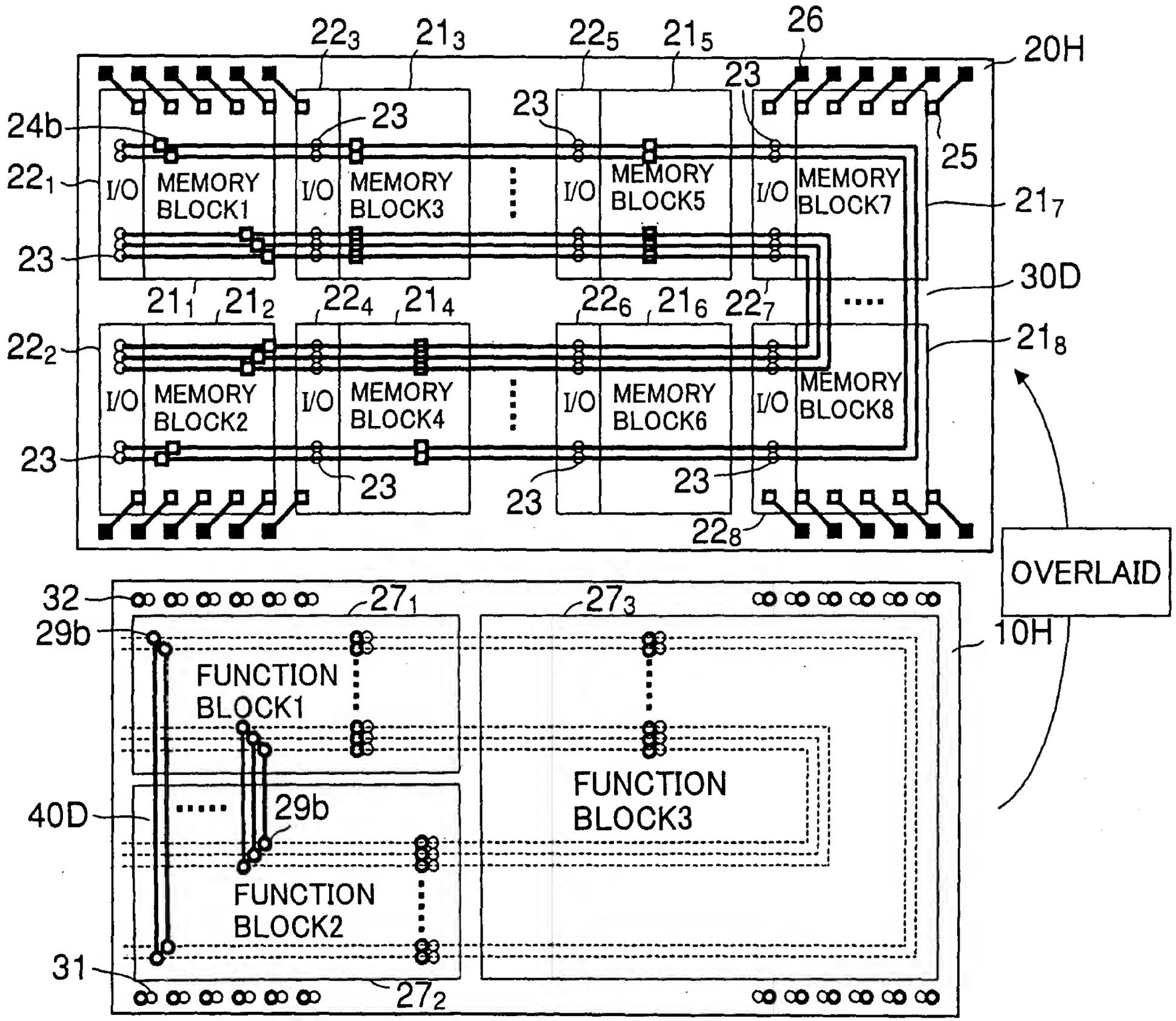

22_3
21_3
22_5
21_5
26
20H
23
24b
22_1
I/O
MEMORY BLOCK1
MEMORY BLOCK3
MEMORY BLOCK5
MEMORY BLOCK7
25
21_7
30D
21_1
21_2
22_4
21_4
22_6
21_6
22_7
21_8
22_2
MEMORY BLOCK2
MEMORY BLOCK4
MEMORY BLOCK6
MEMORY BLOCK8
22_8
OVERLAID
32
27_1
27_3
10H
29b
FUNCTION BLOCK1
FUNCTION BLOCK3
40D
FUNCTION BLOCK2
31
27_2

FIG.23

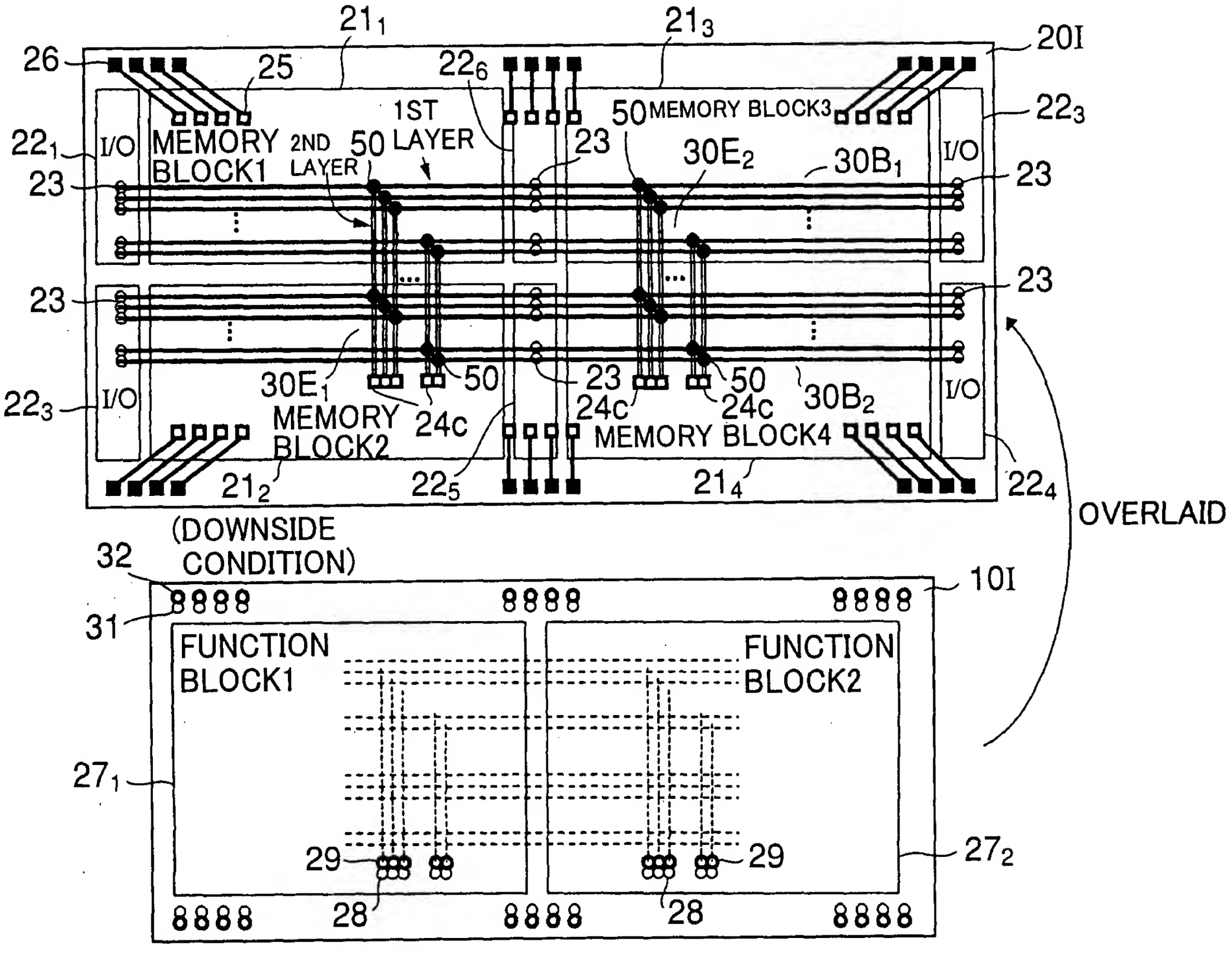

21_1
21_3
20I
26
25
22_6
22_3
22_1
I/O
MEMORY BLOCK1
2ND LAYER
50
1ST LAYER
23
50 MEMORY BLOCK3
$30E_2$
$30B_1$
I/O
23
23
23
$30E_1$
50
23
50
$30B_2$
I/O
22_3
I/O
MEMORY BLOCK2
24c
24c
24c
MEMORY BLOCK4
21_2
22_5
21_4
22_4
OVERLAID
(DOWNSIDE CONDITION)
32
10I
31
FUNCTION BLOCK1
FUNCTION BLOCK2
27_1
27_2
29
29
28
28

FIG. 24

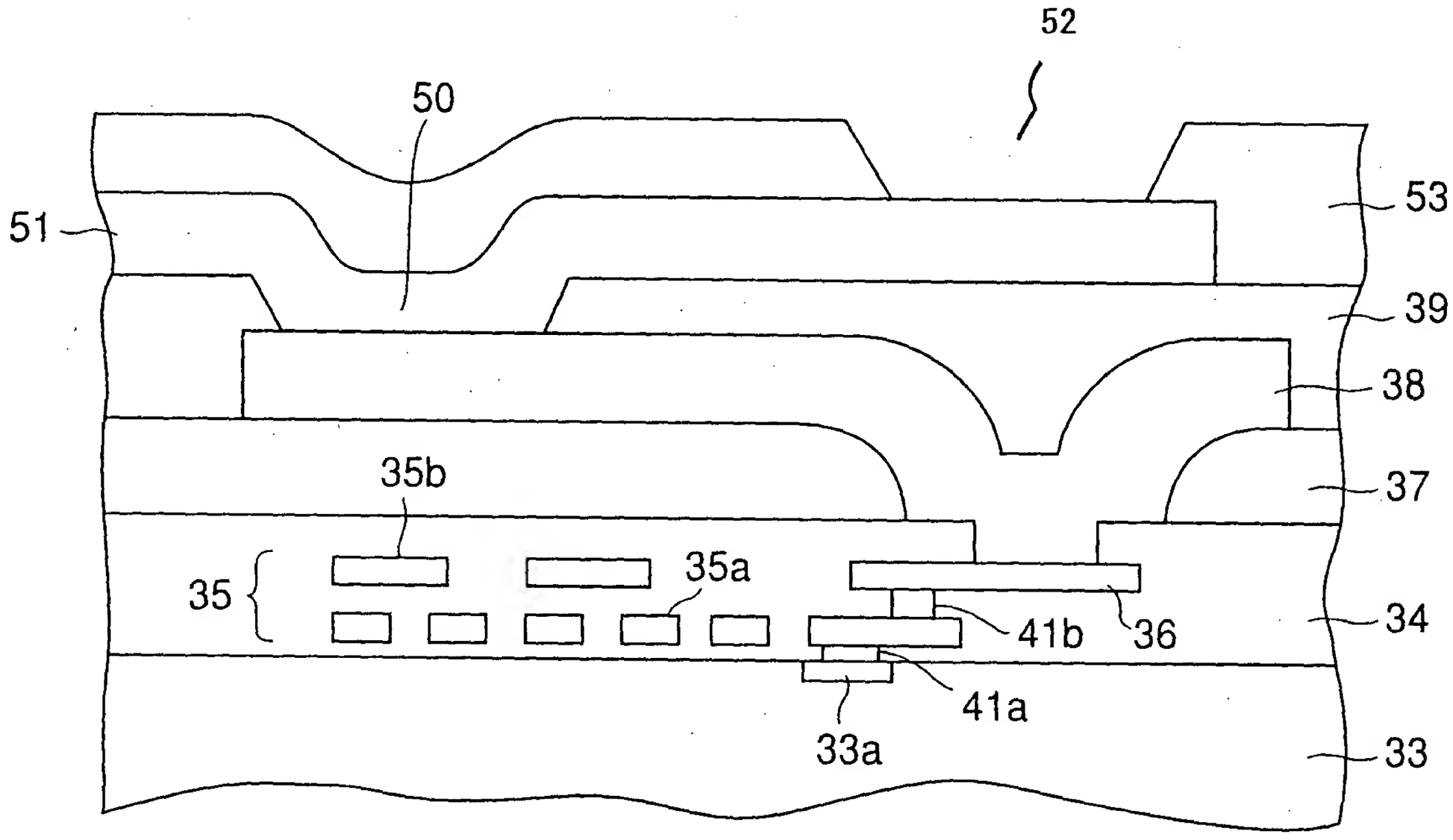


FIG.25

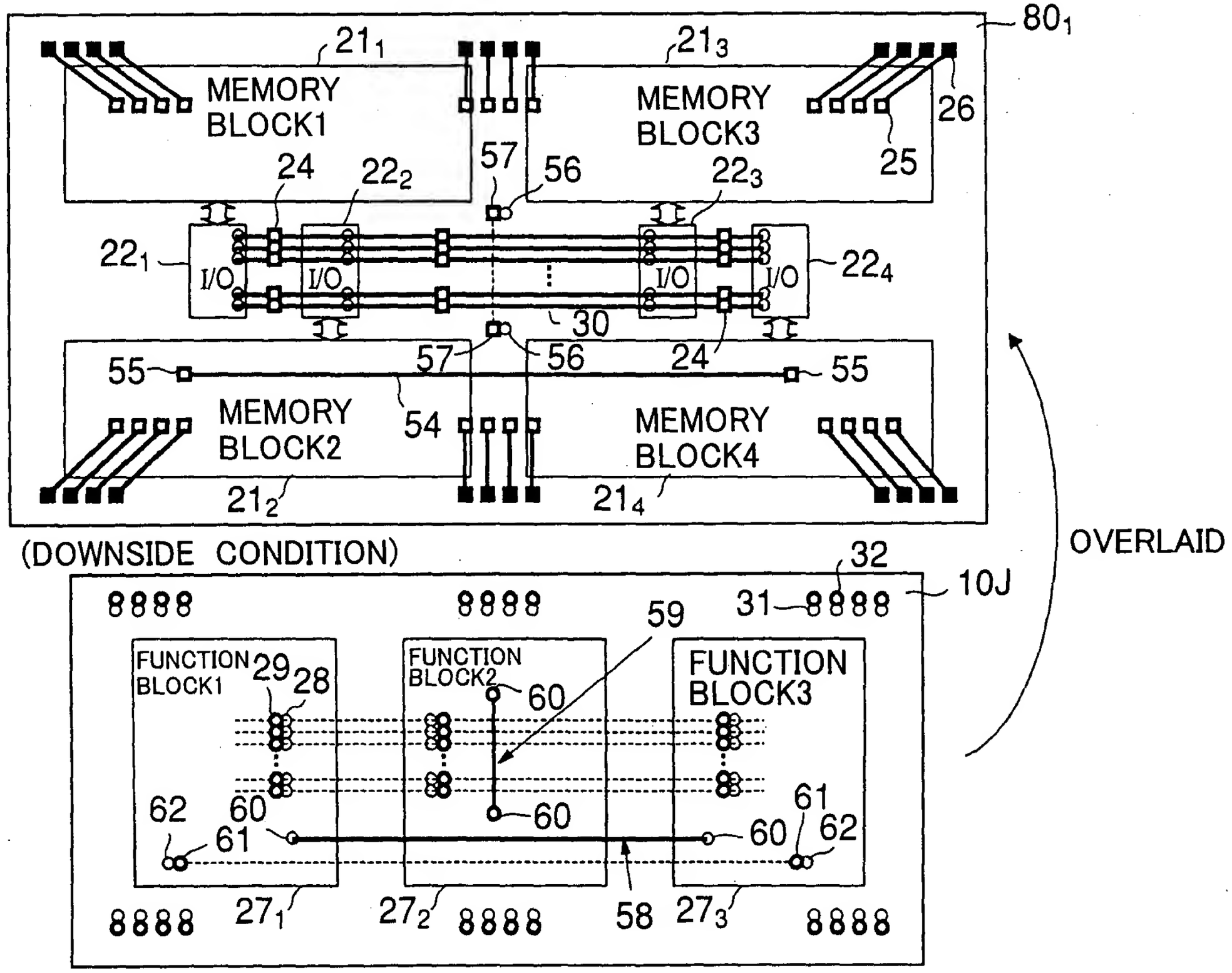

80_1
21_1
21_3
MEMORY BLOCK1
MEMORY BLOCK3
26
25
24
22_2
57
56
22_3
22_1
I/O
I/O
I/O
I/O
22_4
30
55
57
56
24
55
MEMORY BLOCK2
54
MEMORY BLOCK4
21_2
21_4
OVERLAID
(DOWNSIDE CONDITION)
32
10J
8888
8888
59
31
8888
FUNCTION BLOCK1
29
28
FUNCTION BLOCK2
60
FUNCTION BLOCK3
62
60
61
60
60
61
60
62
8888
27_1
27_2
8888
58
27_3
8888

FIG.26

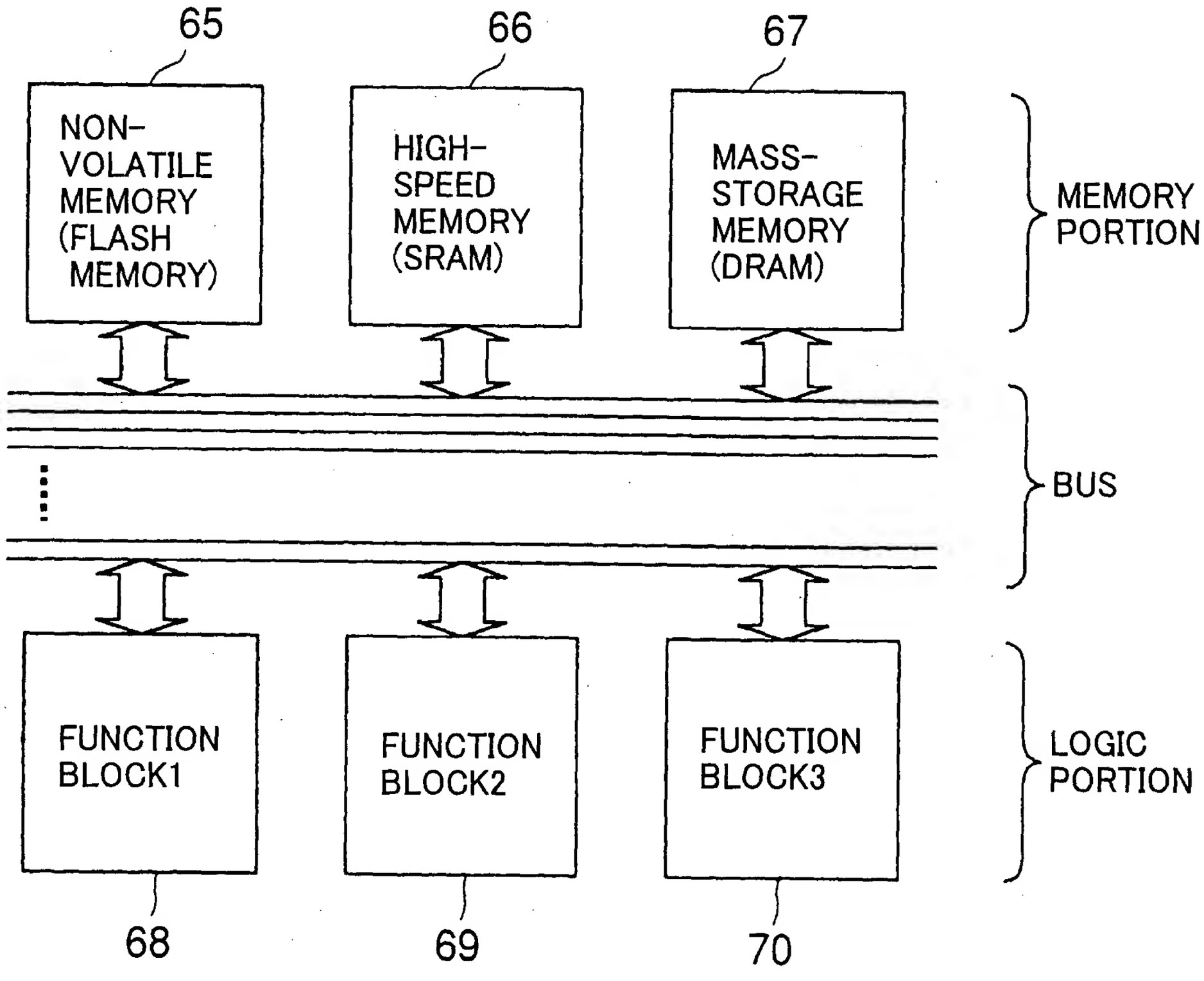

65
66
67
NON-VOLATILE MEMORY (FLASH MEMORY)
HIGH-SPEED MEMORY (SRAM)
MASS-STORAGE MEMORY (DRAM)
MEMORY PORTION
BUS
FUNCTION BLOCK1
FUNCTION BLOCK2
FUNCTION BLOCK3
LOGIC PORTION
68
69
70

FIG.27

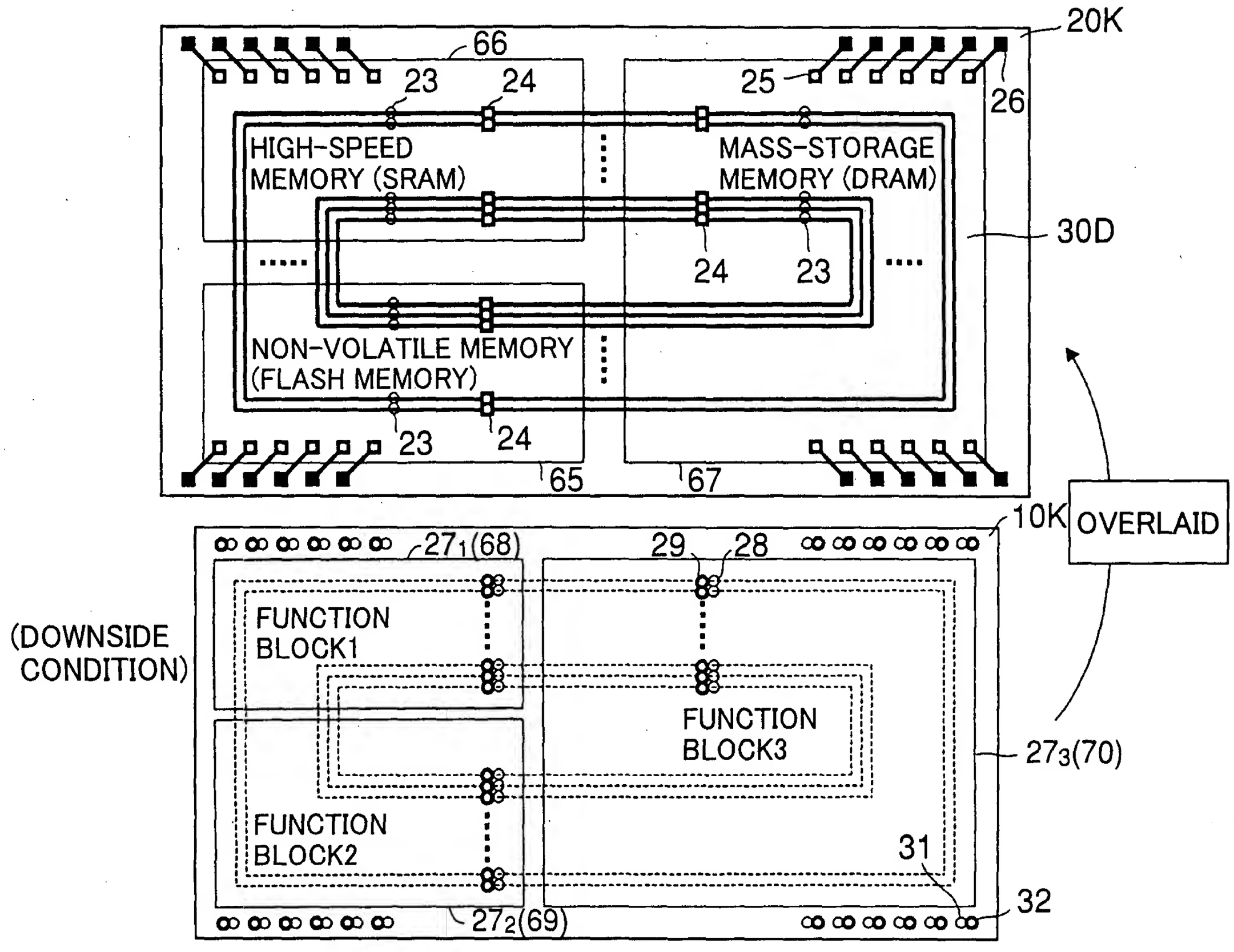

20K
66
23
24
25
26
HIGH-SPEED
MEMORY (SRAM)
MASS-STORAGE
MEMORY (DRAM)
30D
24
23
NON-VOLATILE MEMORY
(FLASH MEMORY)
23
24
65
67
10K
OVERLAID
(DOWNSIDE
CONDITION)
27₁(68)
29
28
FUNCTION
BLOCK1
FUNCTION
BLOCK3
FUNCTION
BLOCK2
27₃(70)
31
32
27₂(69)

FIG.28

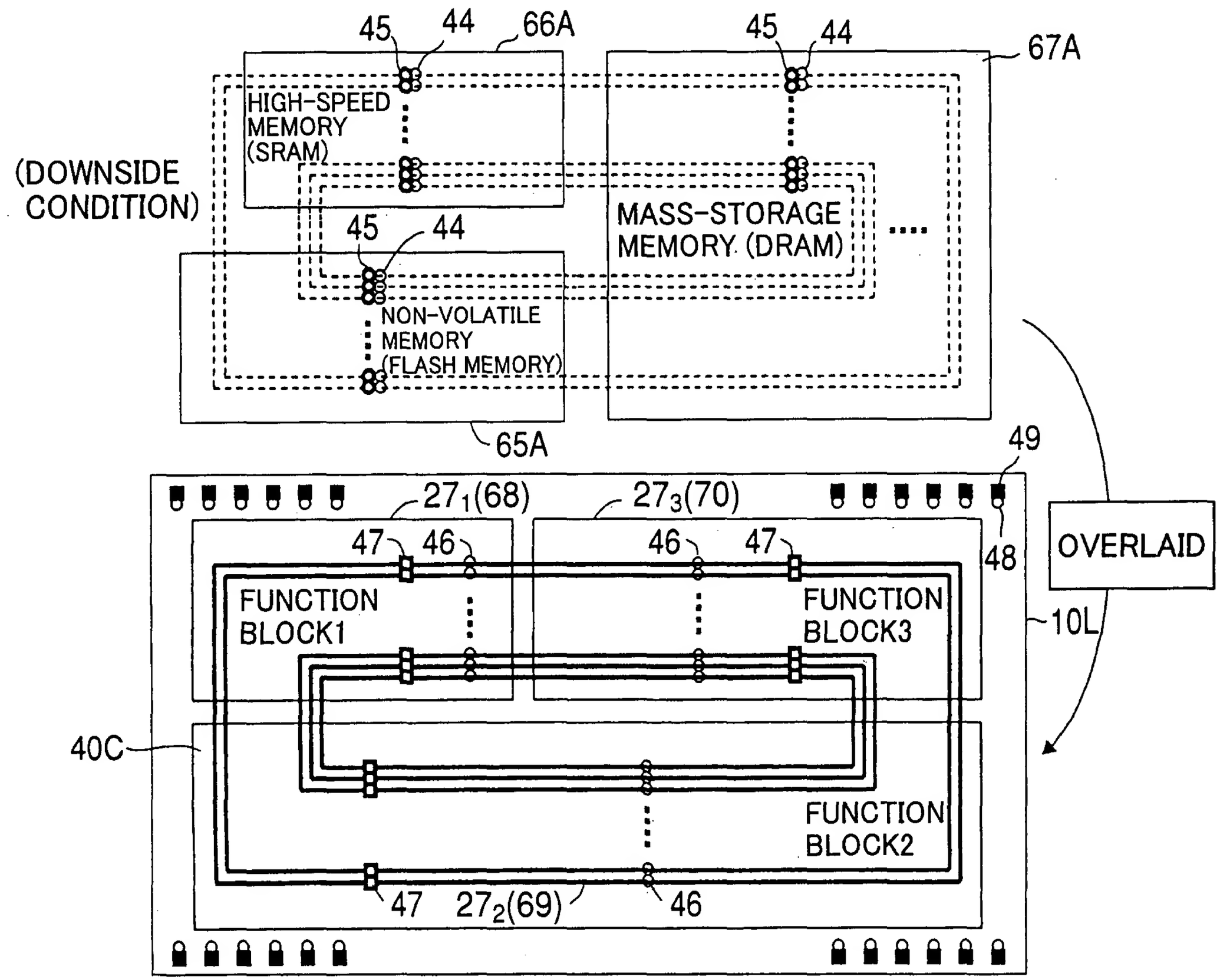

45
44
66A
45
44
67A
HIGH-SPEED
MEMORY
(SRAM)
(DOWNSIDE
CONDITION)
MASS-STORAGE
MEMORY (DRAM)
....
45
44
NON-VOLATILE
MEMORY
(FLASH MEMORY)
65A
49
OVERLAID
27_1(68)
27_3(70)
47
46
46
47
48
10L
FUNCTION
BLOCK1
FUNCTION
BLOCK3
40C
FUNCTION
BLOCK2
47
27_2(69)
46

FIG.29

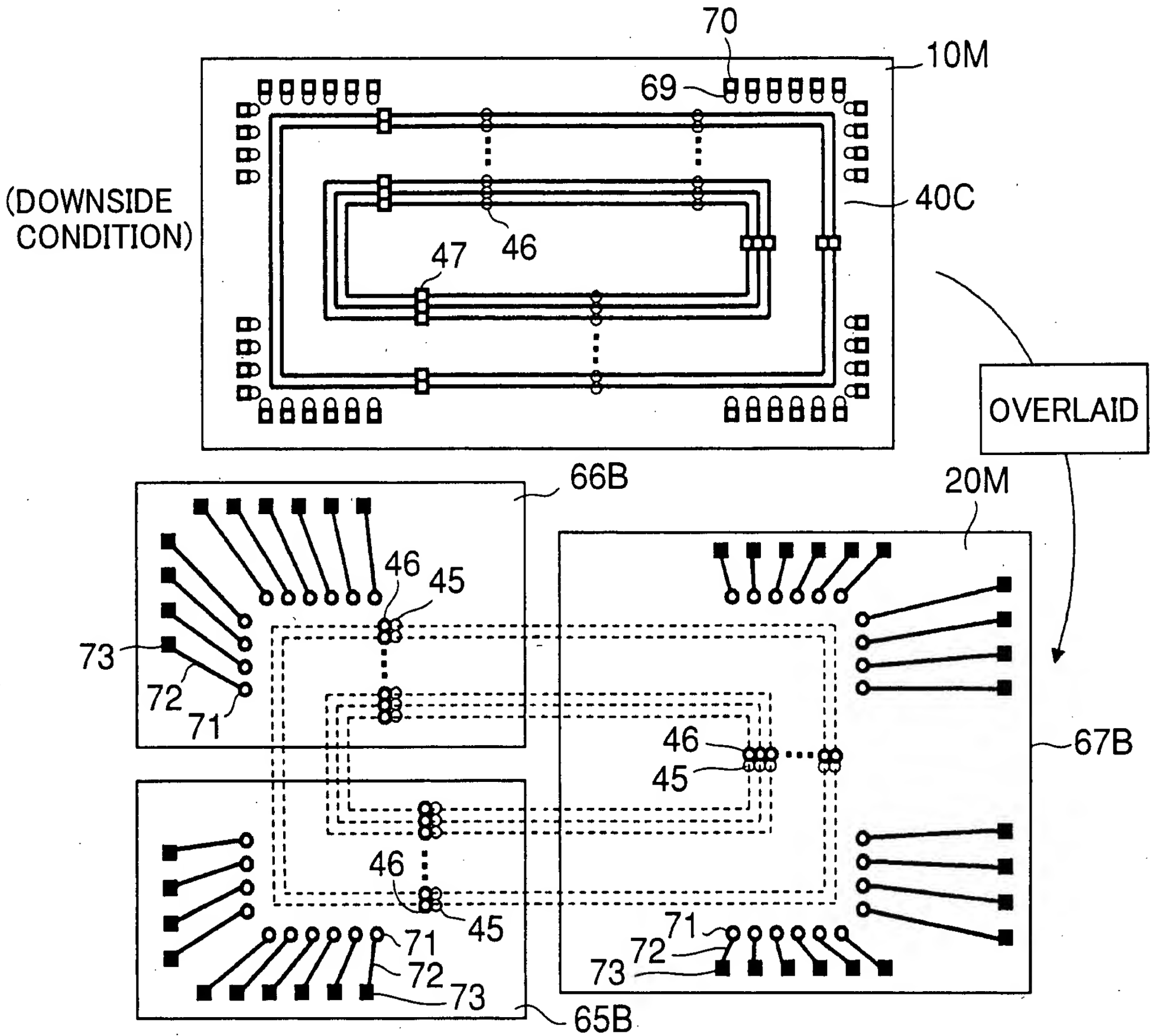

70
10M
69
(DOWNSIDE CONDITION)
40C
47
46
OVERLAID
20M
66B
46
45
73
72
71
67B
46
45
46
45
71
72
73
71
72
73
65B

FIG. 30

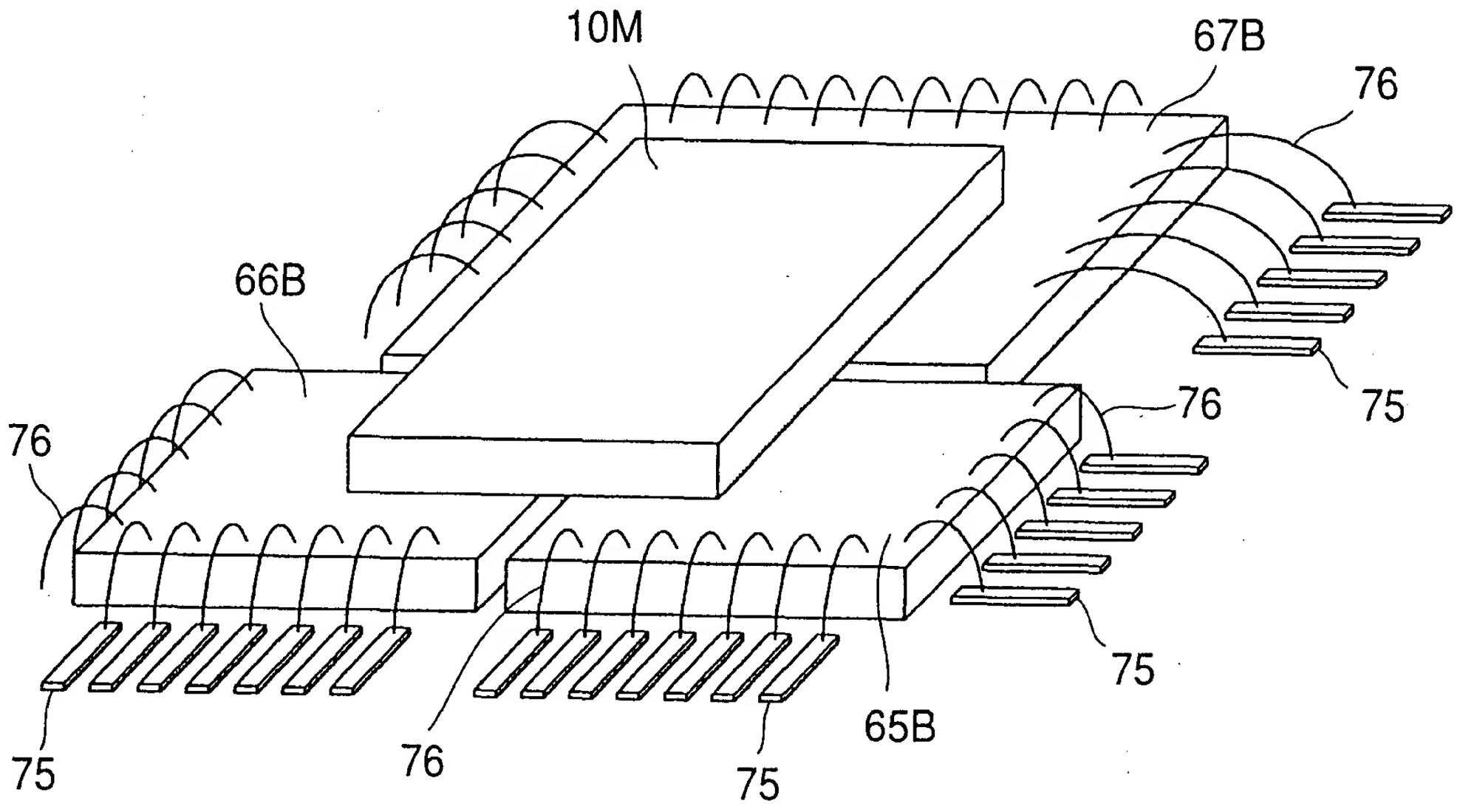


FIG. 31

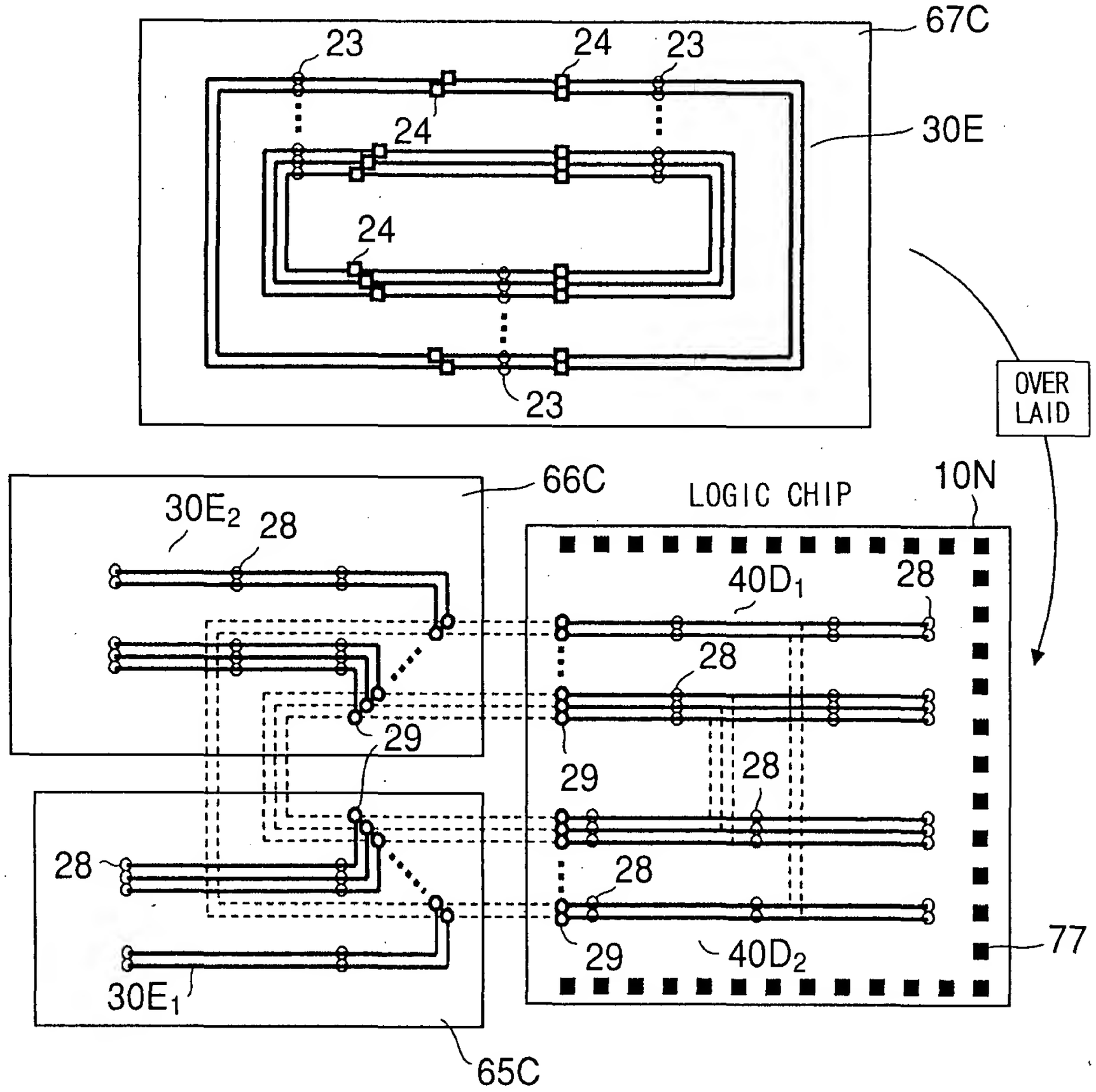

67C
23
24
23
24
30E
24
23
OVER LAID
66C
LOGIC CHIP
10N
30E2
28
40D1
28
28
29
28
29
28
28
29
40D2
77
28
30E1
65C

FIG. 32

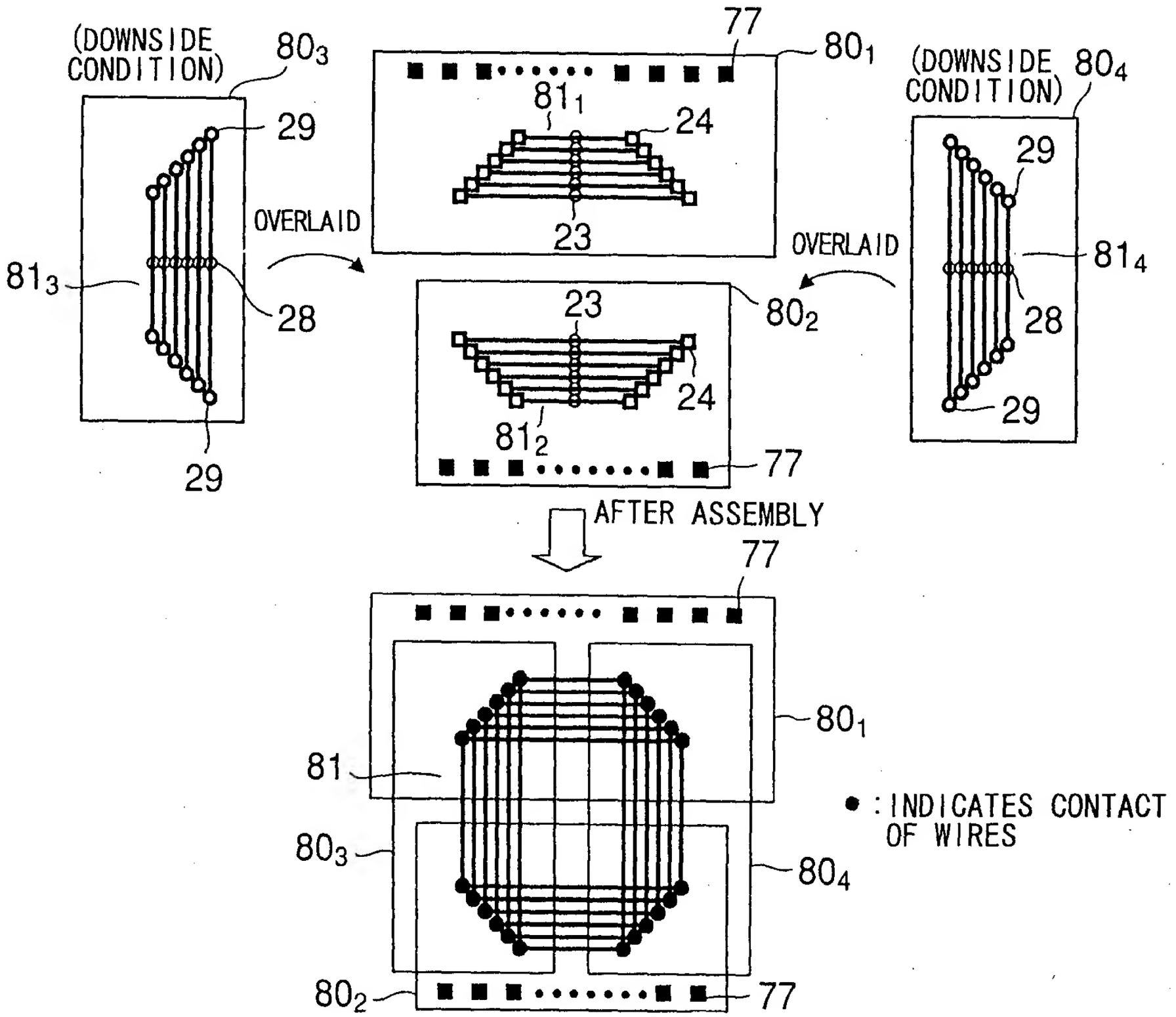

(DOWNSIDE CONDITION)
80_3
29
OVERLAID
81_3
28
29
77
80_1
81_1
24
23
OVERLAID
(DOWNSIDE CONDITION)
80_4
29
81_4
28
29
23
24
81_2
80_2
77
AFTER ASSEMBLY
77
80_1
81
80_3
80_4
80_2
77
● : INDICATES CONTACT OF WIRES

FIG. 33

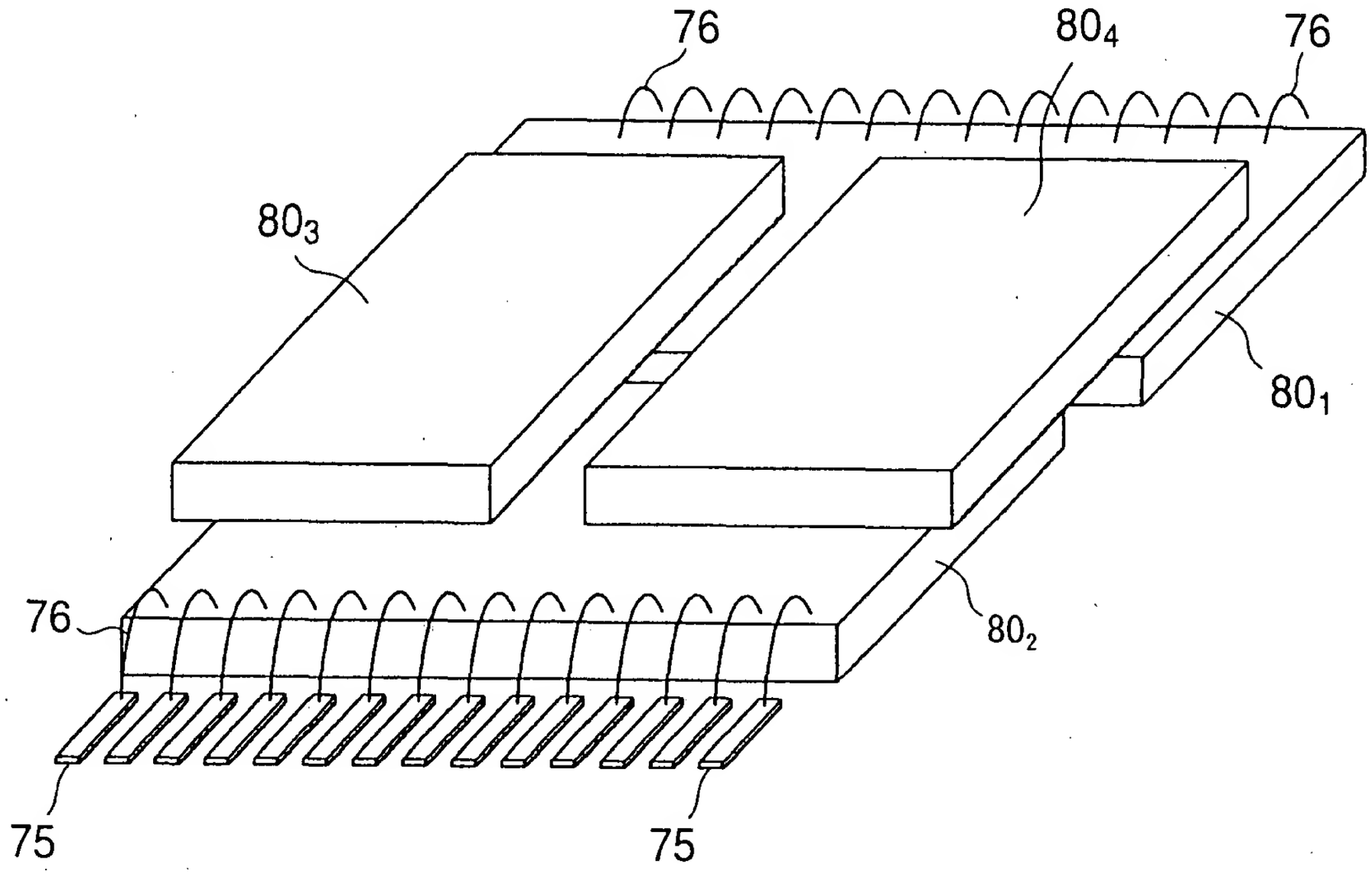


FIG. 34A

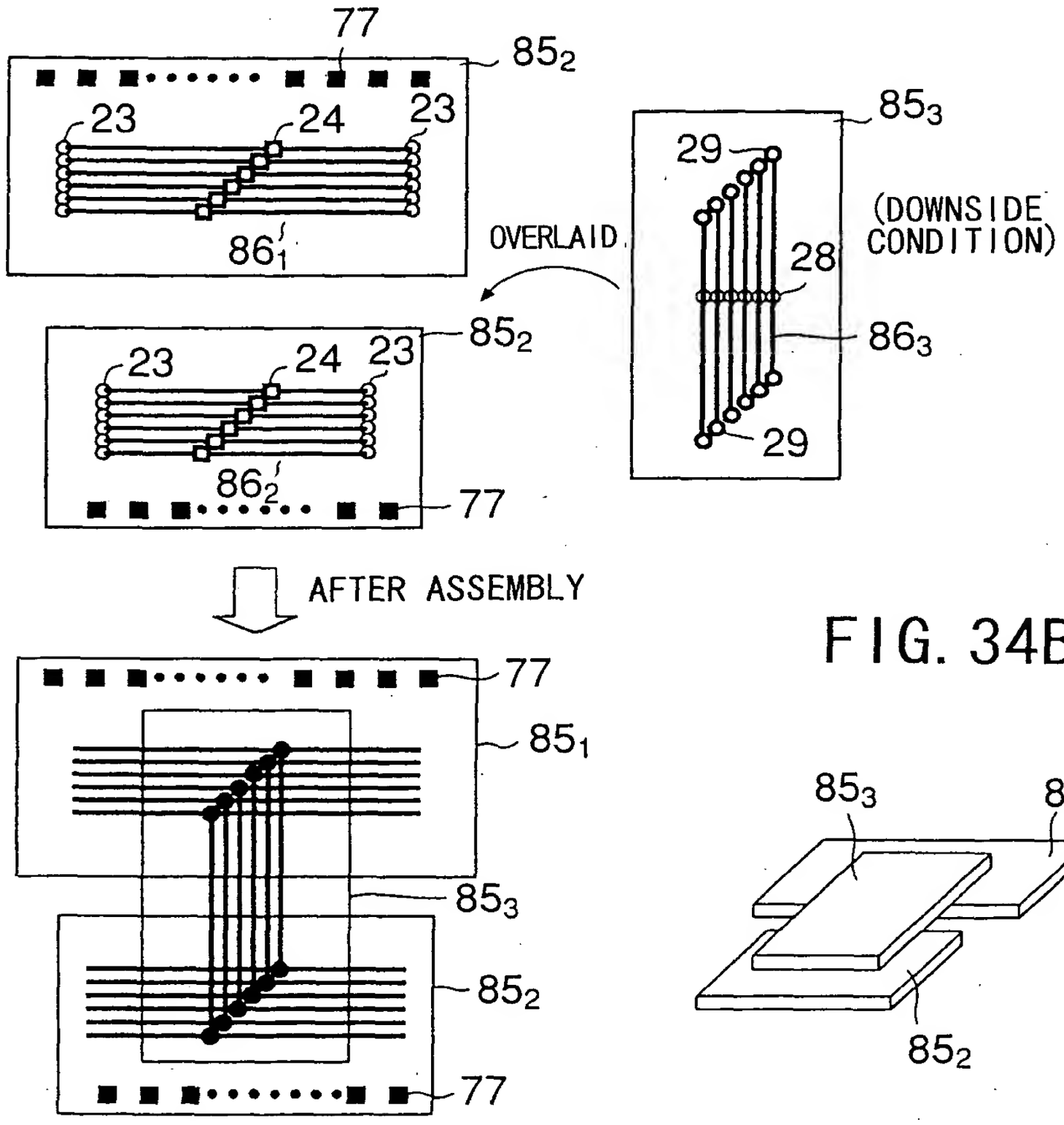


FIG. 34B

FIG.35

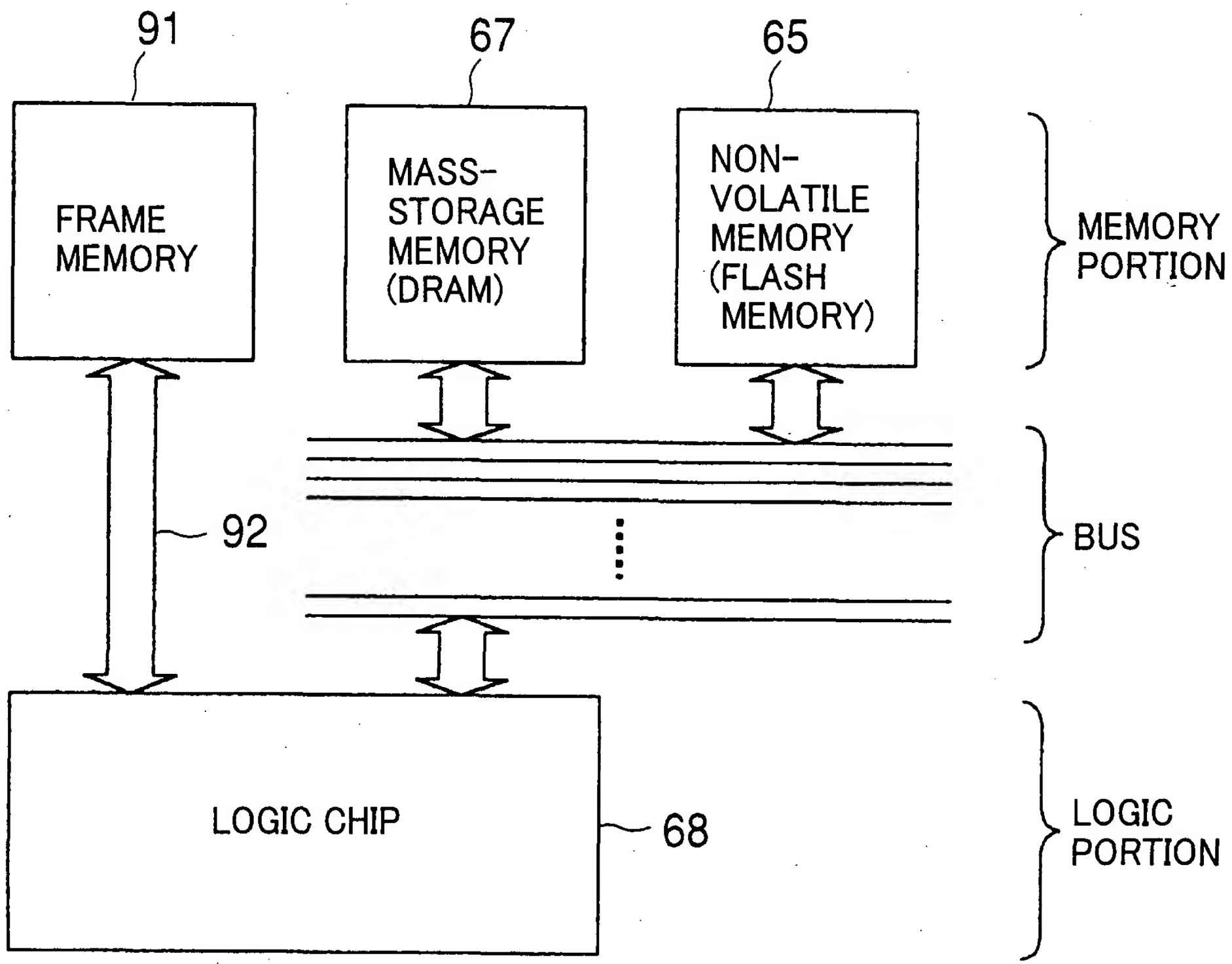

91
67
65
FRAME MEMORY
MASS-STORAGE MEMORY (DRAM)
NON-VOLATILE MEMORY (FLASH MEMORY)
MEMORY PORTION
92
BUS
LOGIC CHIP
68
LOGIC PORTION

FIG. 36

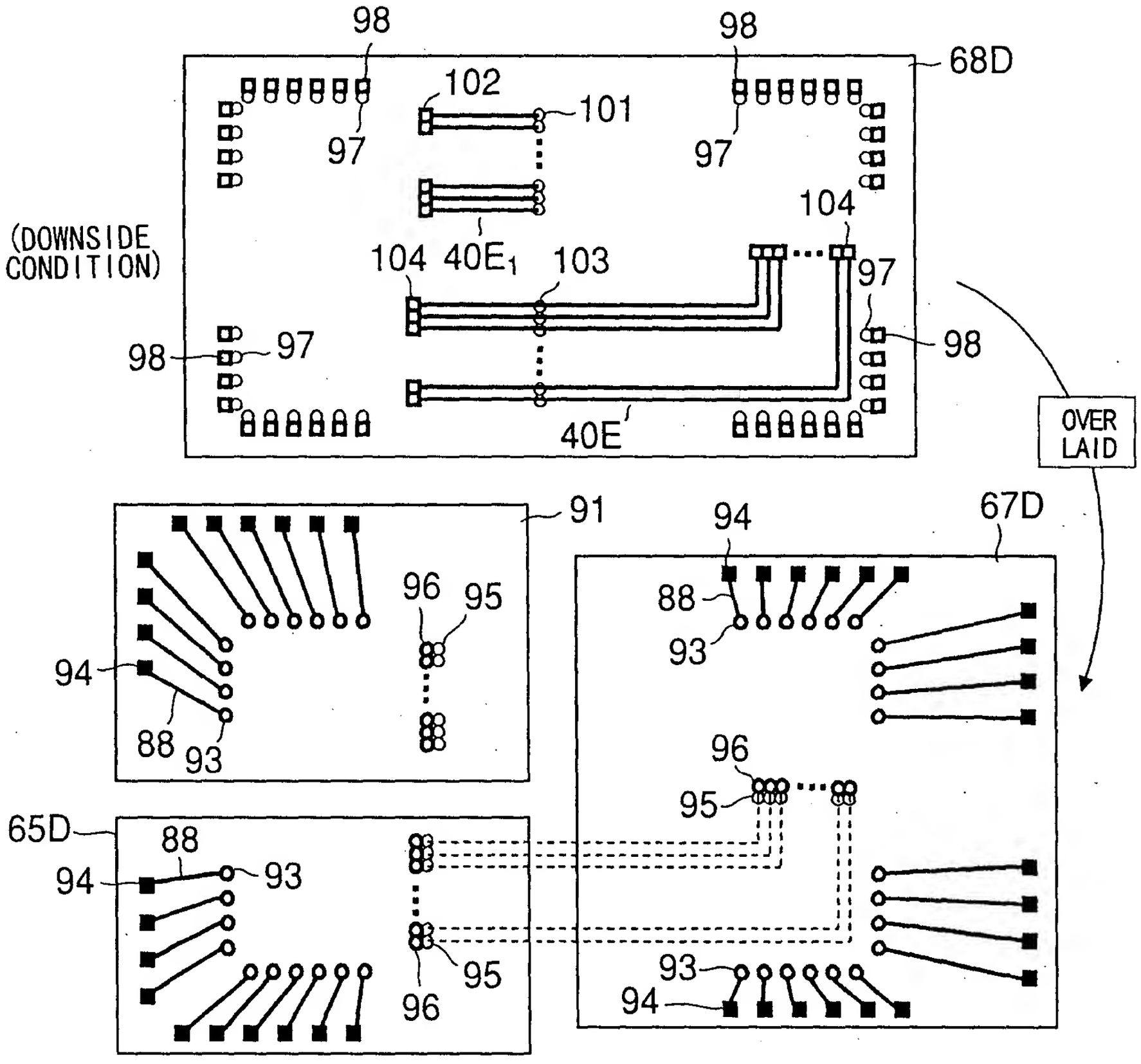

98
98
68D
102
101
97
97
104
(DOWNSIDE CONDITION)
104 40E1 103
97
98
97
98
40E'
OVER LAID
67D
91
94
96
95
88
93
94
65D
88
94
93
96
95
88
93
94
95
96
94

FIG.37

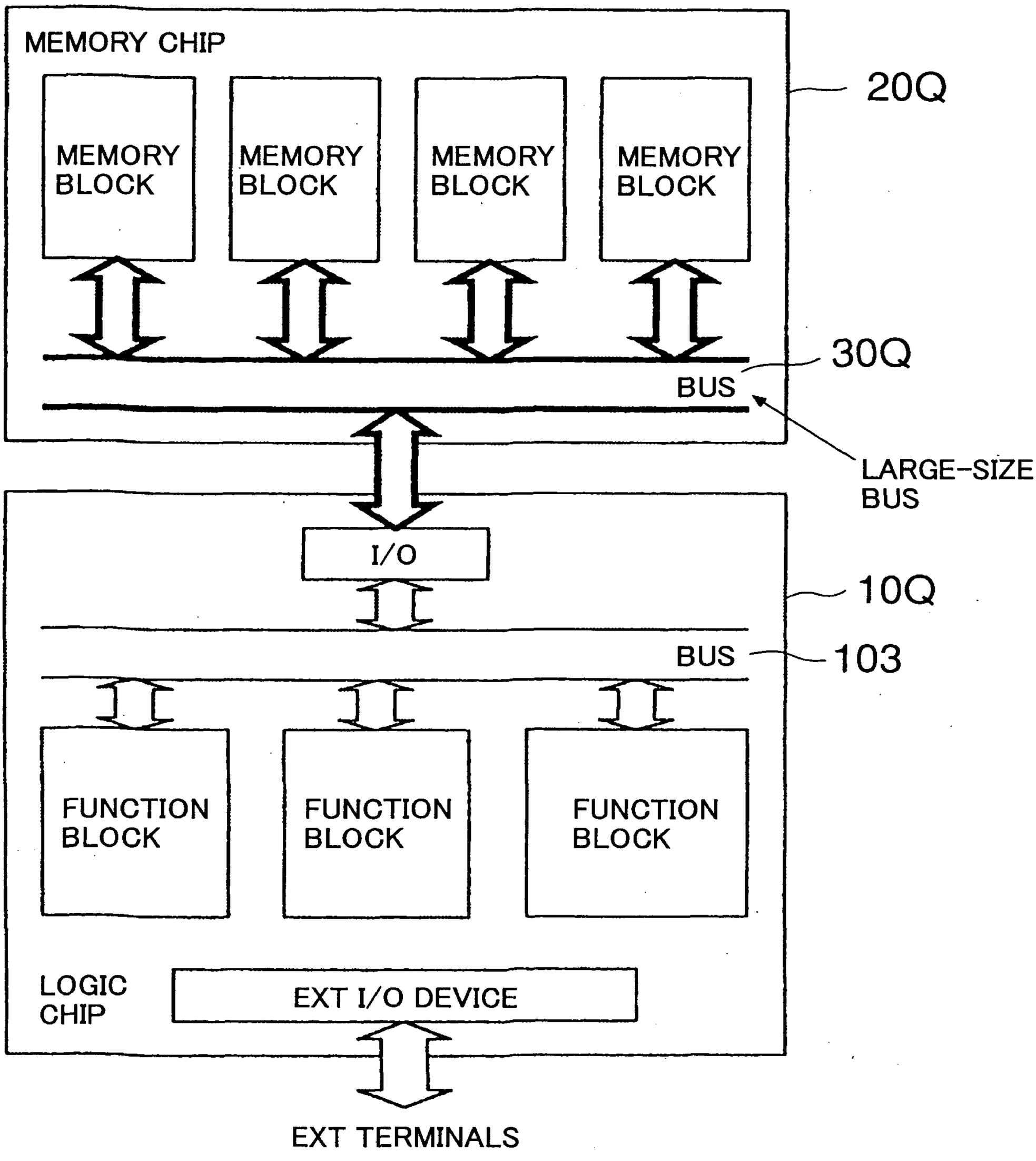

MEMORY CHIP
MEMORY BLOCK
MEMORY BLOCK
MEMORY BLOCK
MEMORY BLOCK
20Q
30Q
BUS
LARGE-SIZE BUS
I/O
10Q
BUS
103
FUNCTION BLOCK
FUNCTION BLOCK
FUNCTION BLOCK
LOGIC CHIP
EXT I/O DEVICE
EXT TERMINALS

FIG.38

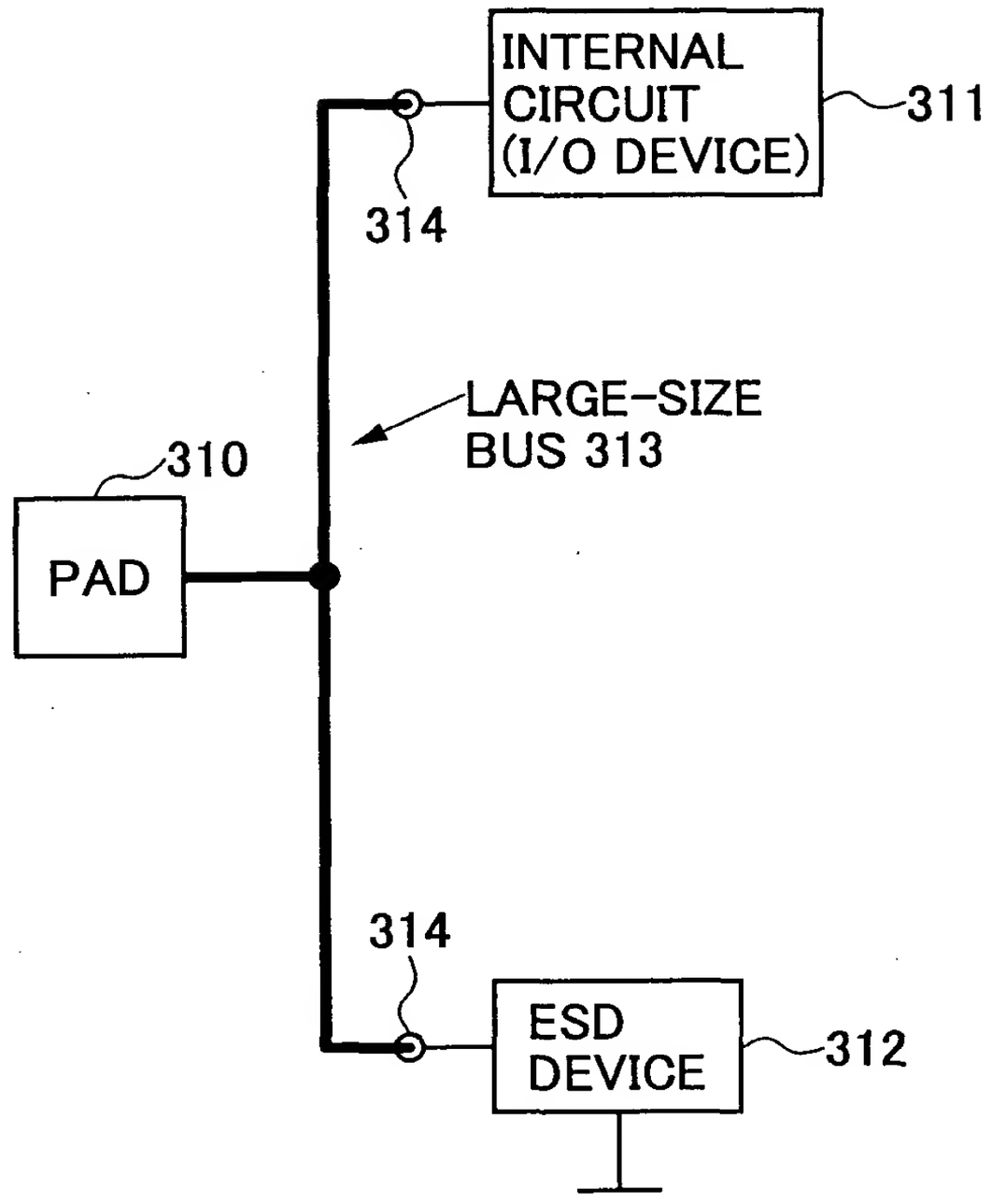

INTERNAL
CIRCUIT
(I/O DEVICE)
311
314
LARGE-SIZE
BUS 313
310
PAD
314
ESD
DEVICE
312

FIG. 39

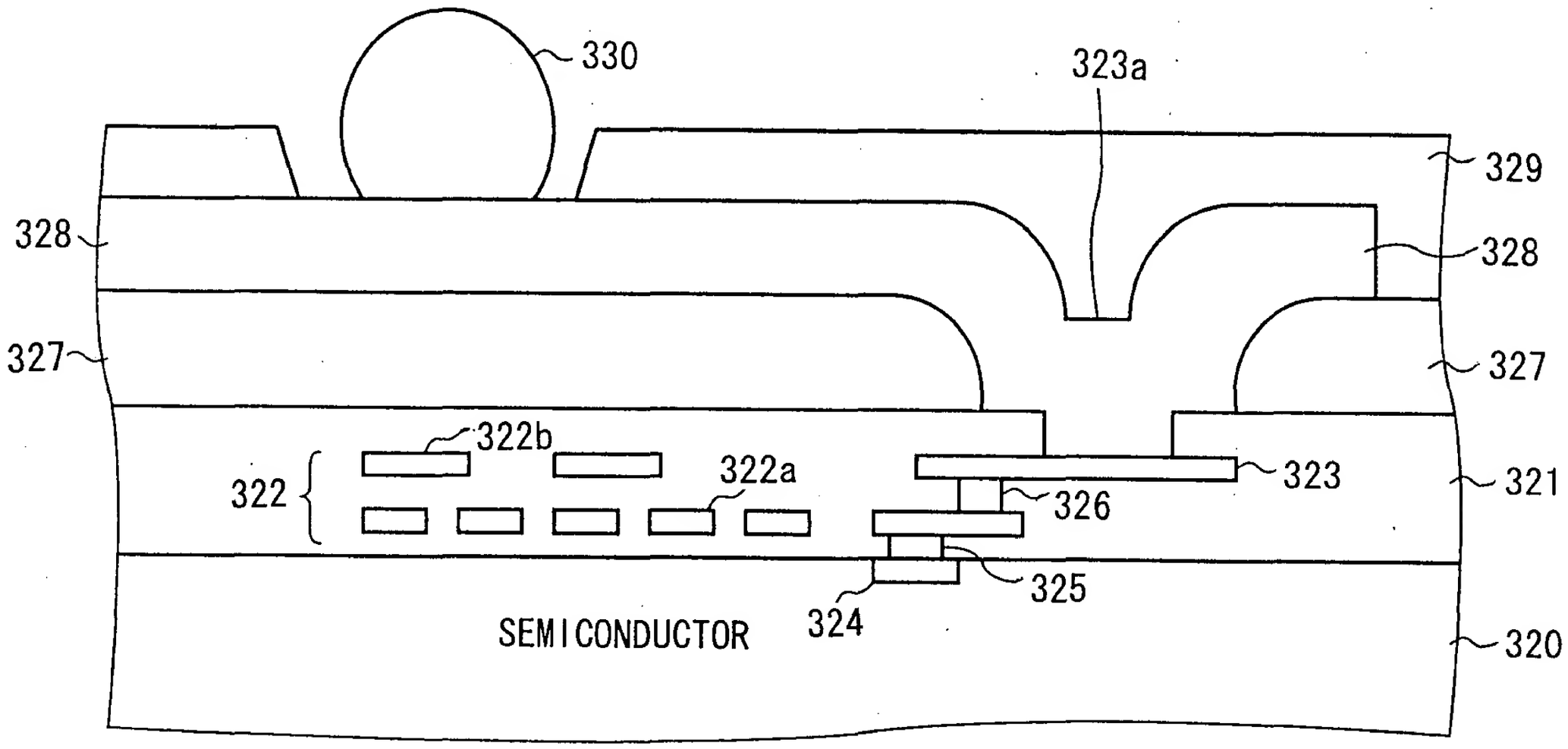

330
323a
329
328
328
327
327
322b
322
322a
323
326
321
325
324
SEMICONDUCTOR
320

FIG.40

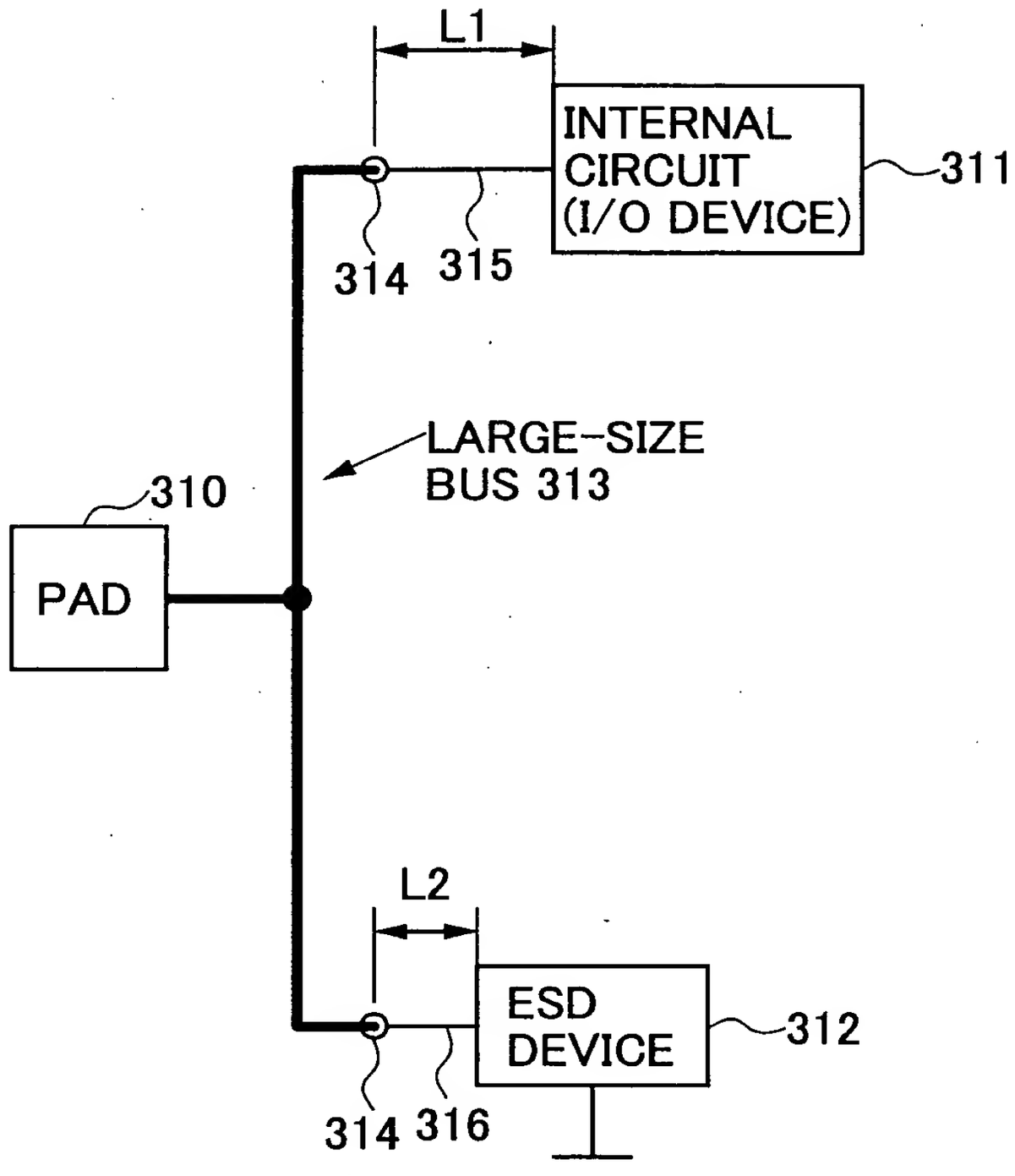

L1
INTERNAL
CIRCUIT
(I/O DEVICE)
311
314
315
LARGE-SIZE
BUS 313
310
PAD
L2
ESD
DEVICE
312
314
316

FIG.41

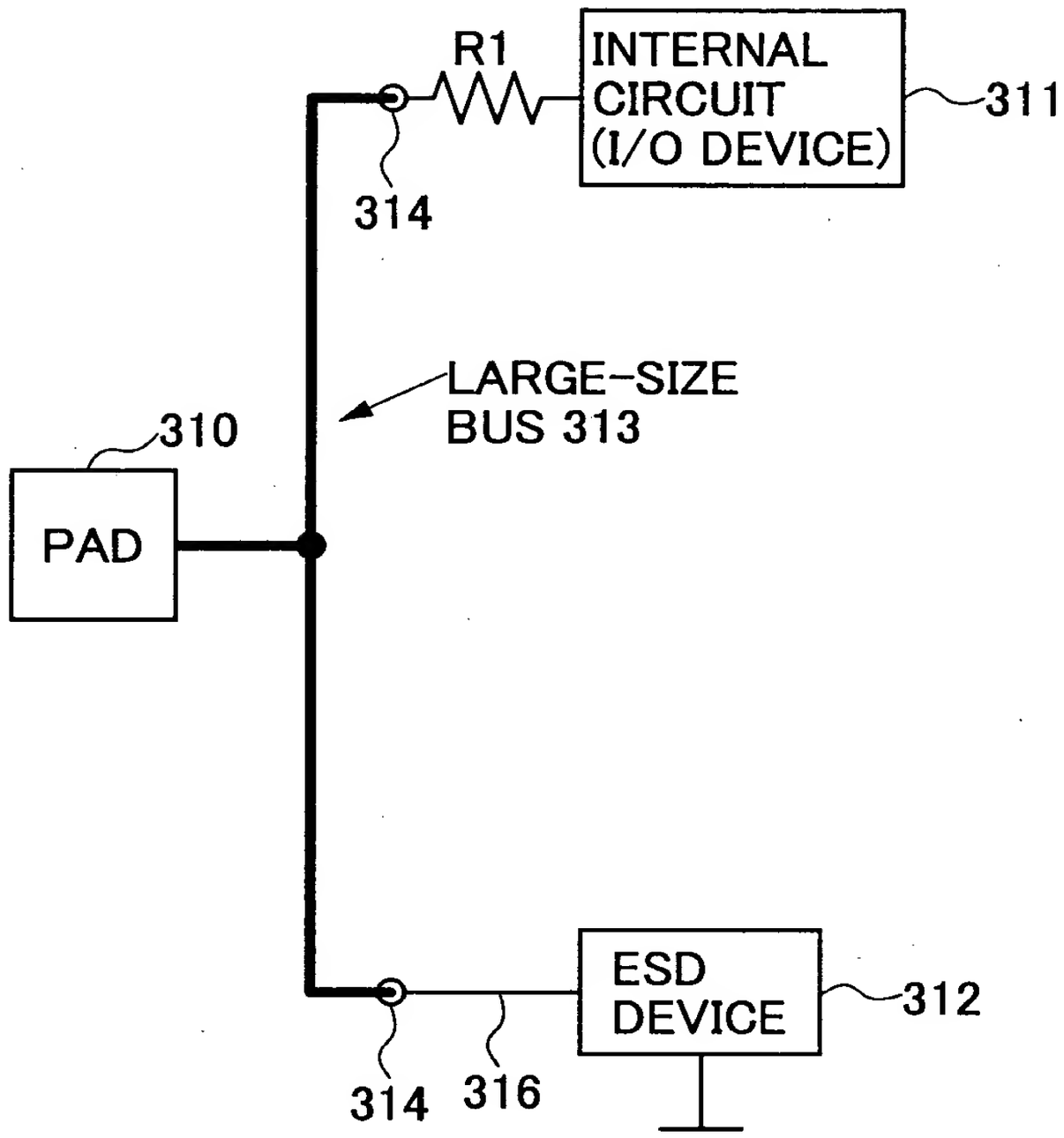

R1
INTERNAL CIRCUIT (I/O DEVICE)
311
314
LARGE-SIZE BUS 313
310
PAD
ESD DEVICE
312
314
316

FIG.42

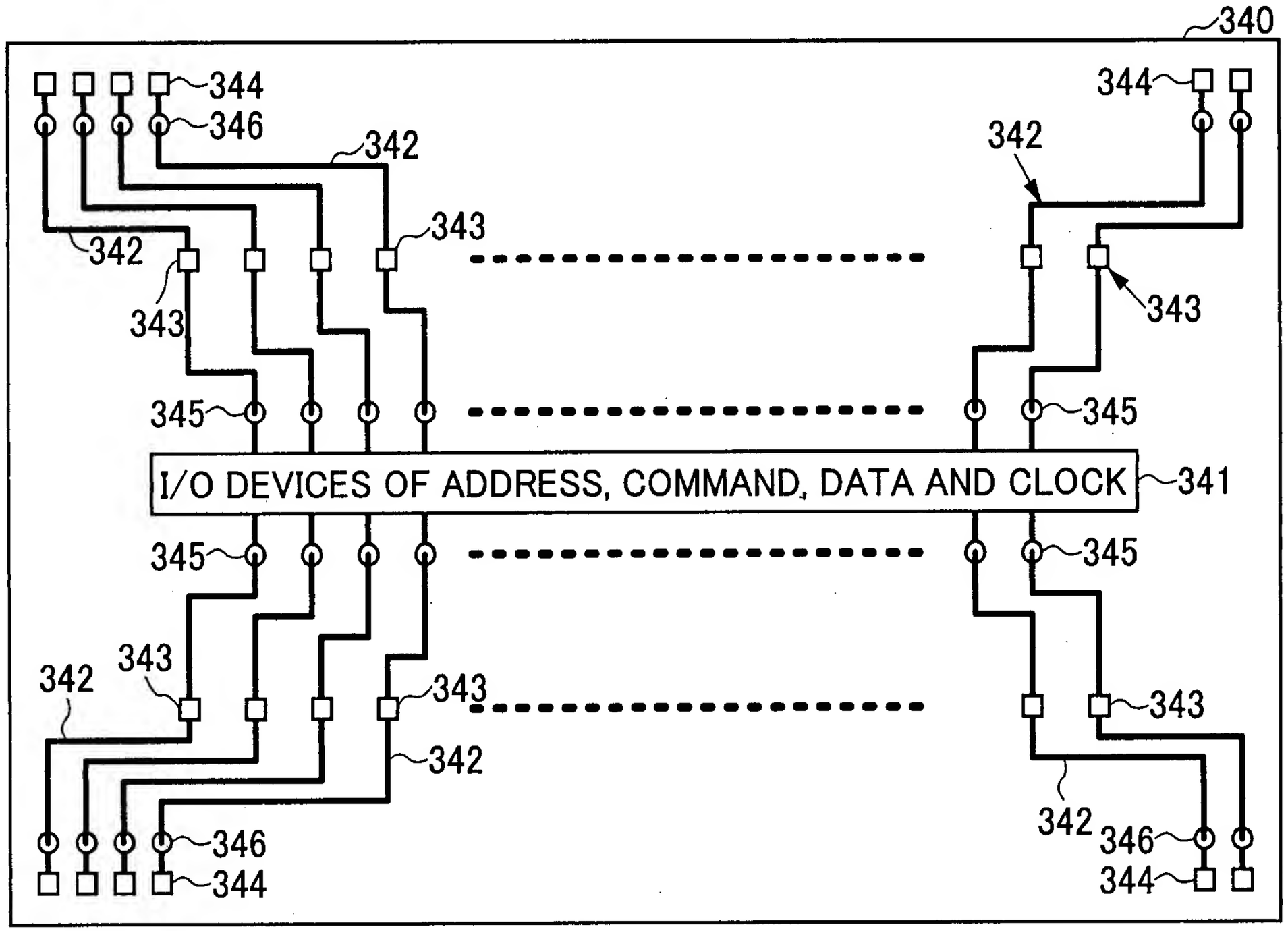

340
344
346
342
343
342
343
345
I/O DEVICES OF ADDRESS, COMMAND, DATA AND CLOCK
341
345
345
343
342
343
343
342
346
344
344
342
343
345
345
346
344

FIG.43

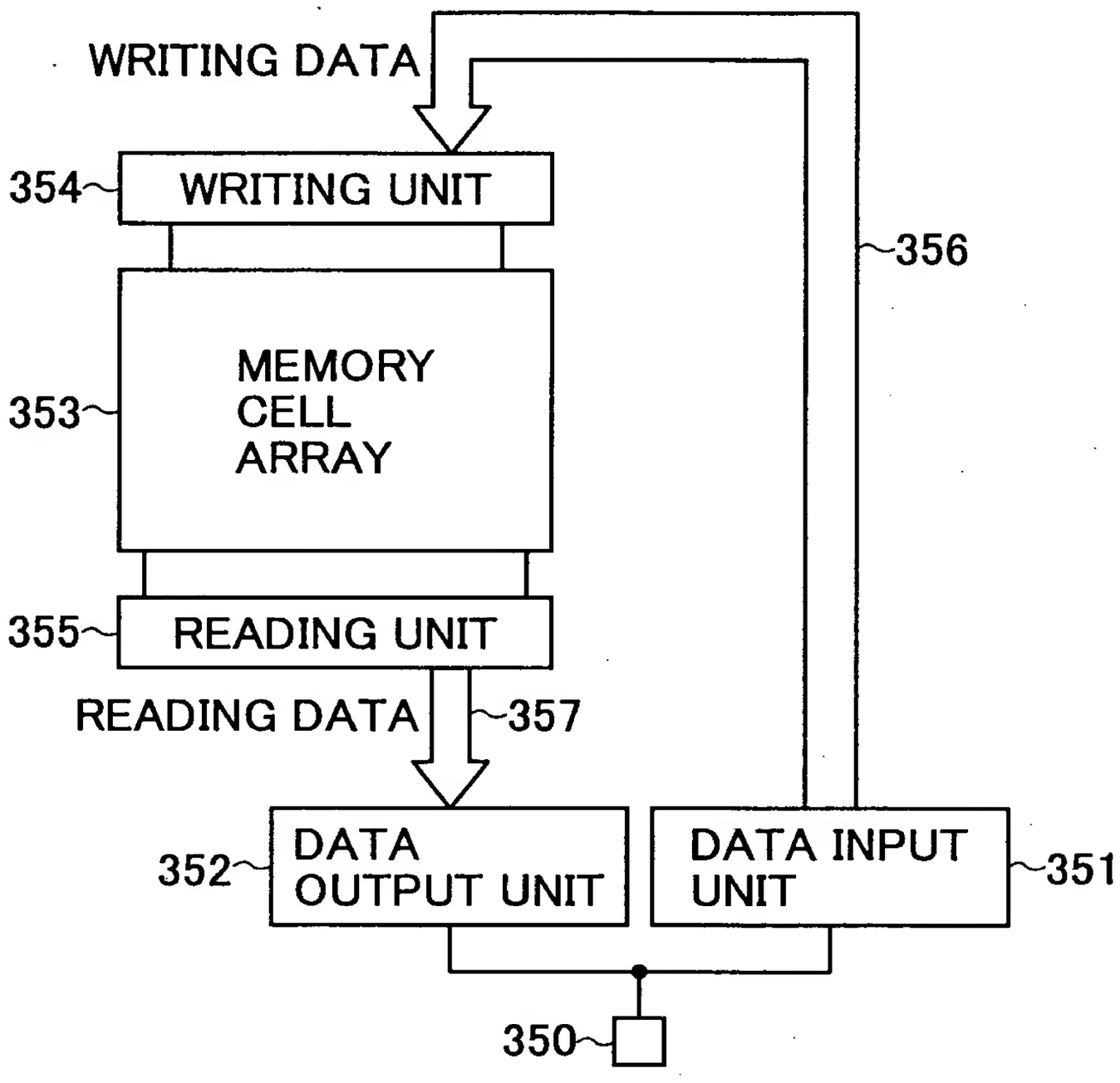

WRITING DATA
354
WRITING UNIT
356
353
MEMORY CELL ARRAY
355
READING UNIT
READING DATA
357
352
DATA OUTPUT UNIT
DATA INPUT UNIT
351
350

FIG.44A

SINGLE-BIT SEMICONDUCTOR APPARATUS

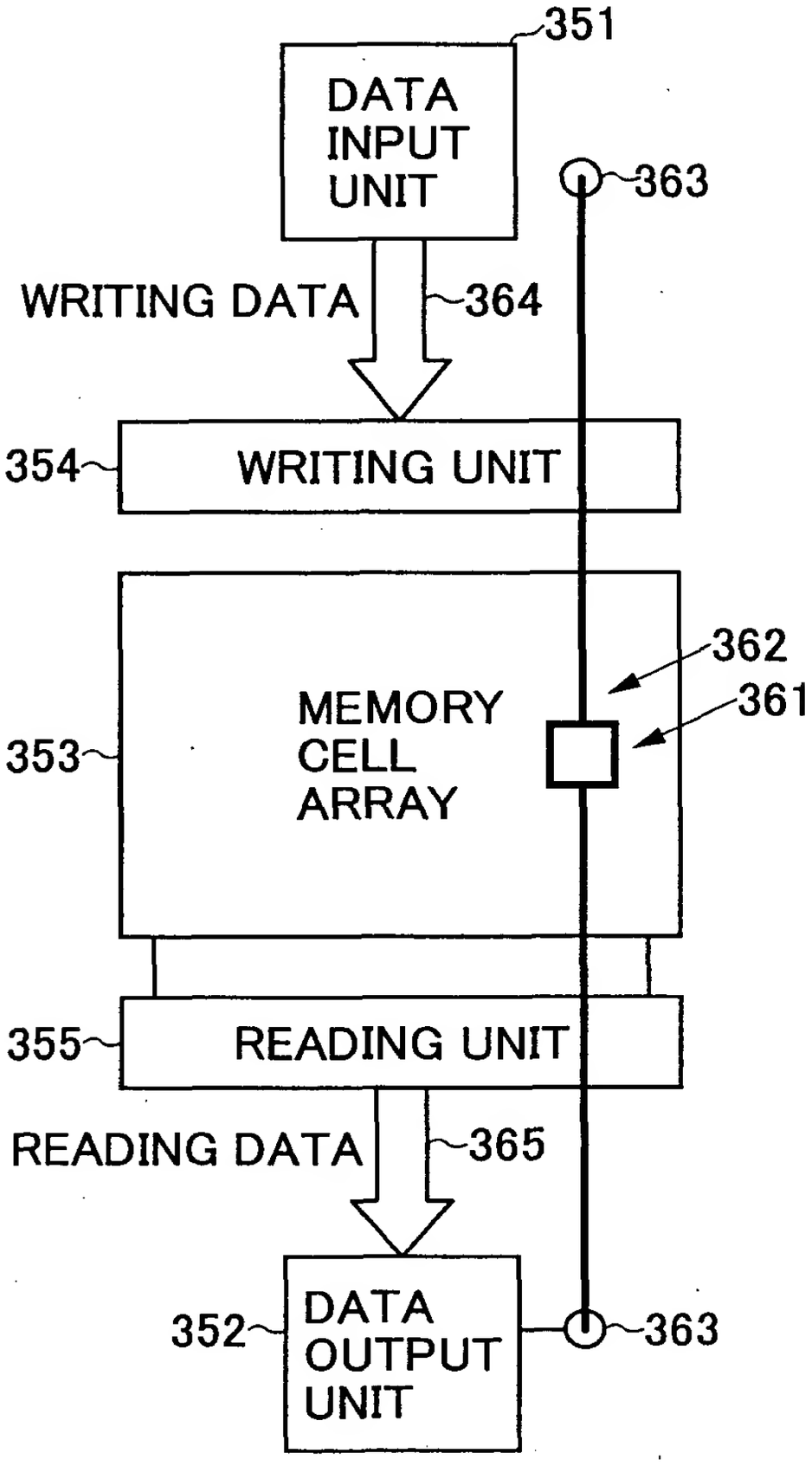


FIG.44B

MULTI-BIT SEMICONDUCTOR APPARATUS